Mud-brick Tomb, near El Kab, Upper Egypt.

# BUILDING METHODS IN EGYPT.

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EGYPT has been described as the chosen home of what is strange and unexampled and paradoxical; as a land eternally and unalterably abnormal. Herodotus in his long list of Egyptian eccentricities illustrates by a variety of curious examples how Egyptian customs are the opposite of those followed elsewhere; and, probably, every modern student of Egyptian affairs could compile his own account of anomalies and peculiarities. Certainly a builder or an architect from Europe, especially if an opportunity be given him of working in every part of the country—in towns, in villages, in the desert, and in the open fields—will gather a variety of strange and interesting experiences, not only in respect of purely local methods, but also in regard to practice imported from Europe.

Extensive foreign participation and co-operation in Egyptian affairs have, of course, brought into the country a large body of people whose manner of life differs widely from that of a large proportion of the native Egyptian; and the methods of construction followed by the latter and replying, from time immemorial, to his manner of life are, not unnaturally, unable to respond completely to the new conditions, and to provide the whole of the requirements of the foreigner or of the Egyptian influenced by foreign ideas. If, however, local methods do not provide all that is needed in an age of change and activity, they are at any rate curiously, though perhaps incompletely, adapted to the physical conditions of the country; and an architect will lose nothing by studying them respectfully. By bearing in mind some of the principles they embody he will be in a better position to devise those new methods and introduce those new materials by means of which he will be able to fulfil the requirements of modern life.

A cursory visit to an Egyptian town or village affords ample and convincing evidence that the manner of life, to which the houses give outward expression, is as far removed from modern European life as the houses themselves are ill adapted to European requirements, not only in respect of plan and general arrangement, but from the point of view of comfort, cleanliness, health, and economy of maintenance. The house does not mean the same thing to an Egyptian and to a European. The former spends more of his time in the open air than the latter,

and this idea is even present in the word used to express a house—a word derived from a root meaning to pass the night. The solidity and finish which we regard as so essential to our comfort and sense of security are both absent in an Egyptian house; and, in consequence, an Egyptian town is apt to present an appearance of squalor and decay by no means pleasant to our eyes. Disorder, dilapidation, and neglect seem, at first sight, to be the prevailing, and indeed, almost the sole characteristics, at least of the lower Egyptian towns. The buildings look as if they were never repaired, and many of them as if any attempt at repair, short of complete reconstruction, would be out of the question. The towns of Upper Egypt are better in this respect than those of Lower Egypt. The better appearance of the Upper Egyptian towns is not, however, due to different and better methods of construction, but to a less rainy, and indeed an almost rainless, climate.

The dilapidated appearance of an Egyptian house is to be attributed, to a large extent, to the condition of the surface rendering of the walls. The surface rendering is an important feature in Egyptian building; but, in order to understand its use, it is necessary to gain a clear appreciation of the nature of an Egyptian wall and of the methods and materials used in the construction of the latter, and, further, to establish the connection between these methods and materials and the prevailing physical conditions of the country. These conditions may be said, broadly speaking, to arise, on the one hand, from the annual miracle of the Nile flood; and, on the other, from the daily miracle of the Egyptian sun. It is of the Nile and the sun that we chiefly think when we think of Egypt; and it is to their influence that the attention of anyone who would build in Egypt must chiefly be directed. They are the enemies who daily seek to destroy his work, and it is against their attacks that he must prepare.

Buildings in Egypt stand in conditions with which it would probably be difficult to find a parallel elsewhere. During the flood season their foundations are in water or in mud; and, after the Nile has fallen, on hard caked clay. The ground forming the bed upon which foundations rest, changes, then, materially in character twice every year. Such changes do not take place without some effect upon the foundations; and, consequently, upon the superstructures of buildings.

A good illustration of the effect of water upon the character of Egyptian soil was afforded by the case of buildings constructed upon uncultivated and unwatered alluvium, forming land which had not been irrigated nor subjected to the results of neighbouring irrigation for a number of years. After this land had been reclaimed, and, by means of pumps, thoroughly soaked with water, the soil expanded and the surface rose as much as half a metre; and, in so doing, wrecked the buildings.

The annually recurring changes in the nature of the soil are not, however, the only changes to which the buildings are subjected. There is an extensive range of temperature, not only between winter and summer, but between night and day. Further, the atmosphere of Egypt is remarkable for its dryness. The effect of rapid and frequent rises and falls of temperature is very marked. In the desert in Upper Egypt, it is possible to hear the rocks splitting as the evening cools after a hot day, making a sound like pistol shots. Experiments have shown that the range of temperature in the middle of a wall three-quarters of a metre thick in Cairo may be 40° Fahrenheit through the year; and that, during the daylight hours, while there was little change of temperature in the heart of the wall, there was a range of eight or nine degrees at a depth of 10 centimetres from the surface in July and August. If temperatures had been taken at night also the range for the whole twenty-four hours would certainly be found to be greater. But practical experience has proved more conclusively than experiment that, under certain circumstances which will be described later, the changes of temperature may be such as to result in stresses greater than a wall can resist.

Buildings in Egypt are, then, almost daily subjected to forces above and below ground which

tend to bring about movements. Below ground the water level is continually changing; and above ground alterations in the temperature, even more frequent, are setting up stresses which are difficult, if not impossible, to calculate.

It is, perhaps, sufficiently clear from the foregoing that Egyptian buildings stand in conditions less ideal than might, at first sight, be inferred from the uneventful appearance of the country. There is, however, another aspect of the case which must be touched upon in order to complete a general summary of local physical conditions. Though the alluvium deposited by the Nile occupies by far the greatest area of the country, yet buildings are comparatively seldom constructed upon it. Building activity is, of course, for the most part, confined to the neighbourhood of towns and villages. Now the floor of Egyptian towns has not been laid down by the Nile, as is the case of the surrounding cultivated land; but has, in the first instance, been deposited by man, with the object of attaining a ground level for buildings above the reach of the floods. The levels of towns and villages have progressively risen through the ages owing to the successive construction of houses upon the ruins of those which have fallen or have been demolished. All village or town land, the level of which is higher than that of the surrounding basin land, is of "made" soil. A soil of a similar character is found also at a level lower than that of the basin land; it occurs on the sites of borrow pits formed by the process of taking earth for making the bricks needed for the construction of houses. These pits are subsequently filled in as a town extends its boundaries, and they form, till filled in, the stagnant unhealthy duck and goose ponds which surround Egyptian towns. The danger of building upon recently "made" soil is too well known to be described. Lastly, there is a desert site which may be sandy or rocky; in the former case it is necessary to remember that gardens may be made round the house, and that the resulting watering may modify the foundation bed upon which the building stands; and, unless guarded against, the results of such watering may appear, at some time subsequent to the completion of the building, in the form of inconvenient cracks caused by foundation settlements.

A STREET IN DAMIETTA, LOWER EGYPT.

The structural problems before the builder in Egypt are, it is seen, by no means simple. Stability must be attained upon a foundation bed which is lacking in that quality, and under temperature and atmospheric conditions which tend to the disintegration of the superstructure. As Egypt is famous for its ancient buildings and hardly less so for its mediæval monuments, it will be interesting to see how the difficulties have been met in the past, and to what extent and in what manner they are overcome by the modern native and European builder.

We have seen that practically the whole area of Egypt is subjected, to a greater or less

extent, to the results of the annual rise and fall in the level of the subsoil water. If, then, foundations are to be laid in conditions not subject to change, they must be laid at the level of permanent saturation. This level is, in a large proportion of cases, at a great depth; it is often six or seven metres below the surface. The cost of laying foundations at that depth would usually be prohibitive. Nor is there any instance of such a course having been followed at any time of Egyptian history, except in the solitary case of the underpinning works carried out in 1898 to the temples situated on the island of Philæ. The tendency has been rather in the opposite direction; that is to say, towards keeping the foundations as near the surface as possible. In ancient Egypt this was so much the case that there can hardly be said to be any foundations at all. Ancient Egyptian work affords, I believe, no evidence of foundations deep enough to reach the lowest level of infiltration water. No attempt seems to have been made towards obtaining equal intensities of pressure upon a ground, nor towards restricting the intensity to as low a unit as possible. It is found that a pressure of four kilogrammes per square centimetre was not uncommon. In these days, the usual practice among European builders is to limit the intensity to one or one and a half kilogramme per square centimetre. This low intensity is thought desirable in view of the compressible nature of the soil when wet. The foundations of the mediæval buildings in Cairo are taken well below the ground level, but never to a depth sufficient to reach the level of permanent saturation. The depth depended, probably, on that of the surface rubbish which, in a comparatively modern town such as Cairo, was not great enough to involve much excavation. The practice followed by the modern Egyptian builders is also to dig until they get through the surface earth and reach the naturally deposited alluvium, or, as they term it, the "black mud." In the ancient towns, such as Tantah, and especially in the most ancient part of that town, known as El Kom, or "The Mound," to dig down to the original ground would be out of the question owing to its great depth below the present surface. For excavation in that part of the town a rule of thumb is followed by the natives. For two-story houses they dig to a depth of two metres and a half, and for three-story houses three metres or three metres and a half. Buildings in the highest parts of ancient towns must necessarily stand upon foundation beds of "made" earth compacted only by time.

A DOORWAY, AKHMIM, UPPER EGYPT.

No particular attention has, then, in the past been paid by Egyptians to the varying levels of the subsoil water as a determining factor in the problem of choosing a foundation bed for buildings. The practice has been, and still is, to regard the character of the soil, rather than the level of the subsoil water; and to build, if possible on the black alluvium, if not, upon "made" earth compacted by time, or, as in ancient Egypt, probably by ramming and watering.

As no attempt is made to get out of reach of the effects of the rise and fall of the infiltration water, we must turn to the structure itself to discover what methods are taken to adapt it to the inevitable slight movements which must occur from time to time.

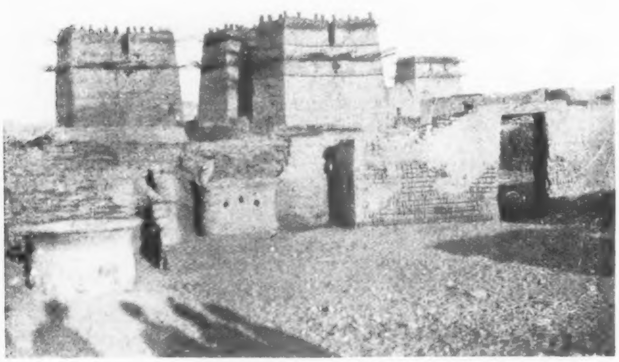
The original building material in Egypt was without doubt mud brick. This material is still used to a very large extent; and although for important work it has been replaced by stone and burnt brick, yet the traditional conception of walling derived from mud-brick construction has remained throughout history inherent in the Egyptian builder; and it is possible to detect through all Egyptian work—ancient, mediæval, and modern—the dominating presence of those ideas which originated from mud-brick construction.

This would not be the place to trace the evidence which exists of the transition from the use of mud brick to that of stone; nor to discuss whether the use of the latter was due to the discovery of copper and the development, from this discovery, of tools capable of working stone; or whether the ancient Egyptians were pushed to using stone, and consequently to the discovery of some means of working it, by the climatic conditions of Lower Egypt, where the occasional heavy rainfalls would destroy mud brick. However this may have been, it is abundantly clear that, when they did make use of stone, they used it, structurally, in much the same manner as they had used mud brick; and if it would be too much to say that they never arrived at a complete appreciation of the structural meaning of stone, the manner in which they used it in walling shows, if not invariably, at least in a large proportion of cases, that they continued to think, structurally, in mud sun-dried bricks or mud and reeds. There is little if any structural difference between a stone and mud-brick "mastaba," a stone and mud-brick pyramid; the walls and gateways of many temples might have been built in mud brick without altering their shape or size; and even many of the columns look as if they could be built in mud if it were reinforced by reeds or other binding material.

AT MANFALUT.

The wall of a building in sun-dried brick and mud mortar is a very fairly homogeneous structure; there is no difference between the material forming the mortar and that of the bricks; and, once the whole has hardened, it is not far from being a single mass with nearly equal powers of resistance throughout. A building in stone, however, if it is to approach in homogeneity a building in mud and mud mortar, must be constructed with a mortar capable of setting as hard or nearly as hard as the stone, and of adhering to the stone as mud mortar adheres to a mud brick. In the absence of such a mortar, bond becomes in our eyes a most important element, especially as it is necessary to economise material. But if, as it appears must have been the case in ancient Egypt, conditions of life are such as to render it unnecessary to study economical methods, the stimulus required to evolve the idea of bond is absent; and stability is gained simply by mass rather than by method, the stones being put together for walling purposes with no regard for through bond, and thickness being gained not uncom-

monly by building three or more walls side by side with nothing to connect them. In the case of a mud-brick wall also, it is to its mass that stability is due; a thin yet stable mud-brick wall is inconceivable. It would seem, then, that the absence of bond in Egyptian masonry may be explained by the persistent existence of the mud-brick tradition. The work of the Coptic period, which is, of course, on an incomparably smaller scale than the ancient Egyptian masonry, shows the same absence of bond and the same mud-brick traditions in many of its forms of walling. The monasteries of Deir el Abyad and Deir el Ahmar in Upper Egypt recall, in their thick-battered walls and cavetto cornices, ancient Egyptian work. When ashlar was used in the Coptic period it was employed only as a facing held in its place by its own weight and by wooden beams laid longitudinally, rather than by being bonded through from face to face, or even with the rubble-stone core of the wall. The walls depend, therefore, on their thickness for such stability as they possess. During the Mohammedan period most of the walling presents similar characteristics, though, of course, fine examples of masonry work are found, especially in the work of the Fatimite dynasty. But it must be remembered that the buildings of the Mohammedan period owe their existence largely to influences foreign to Egypt. In modern Egypt one of the most noticeable features in Egyptian methods of walling is the absence of bond. Builders will, if left to themselves, show little or no appreciation of its importance as a means of attaining stability combined with economy of material. In modern work, as in Coptic work, there is much to recall the forms found in ancient Egypt; as, for instance, in the pigeon-houses of Upper Egypt; and in the dwellings themselves, which, both in Upper and in Lower Egypt, are often crowned with the familiar cavetto cornice springing from the top of a wall battered in the ancient manner.



PIGEON-HOUSES, NEAR EL KAB, UPPER EGYPT.

If truly Egyptian methods of construction are to be studied in these days, it is best to search in the provincial towns of Upper and Lower Egypt, more especially in Upper Egypt, rather than in the larger towns of Cairo and Alexandria. In the latter towns, as in many of the Delta towns, European influence is so extensive that foreign methods have largely modified the native practice.

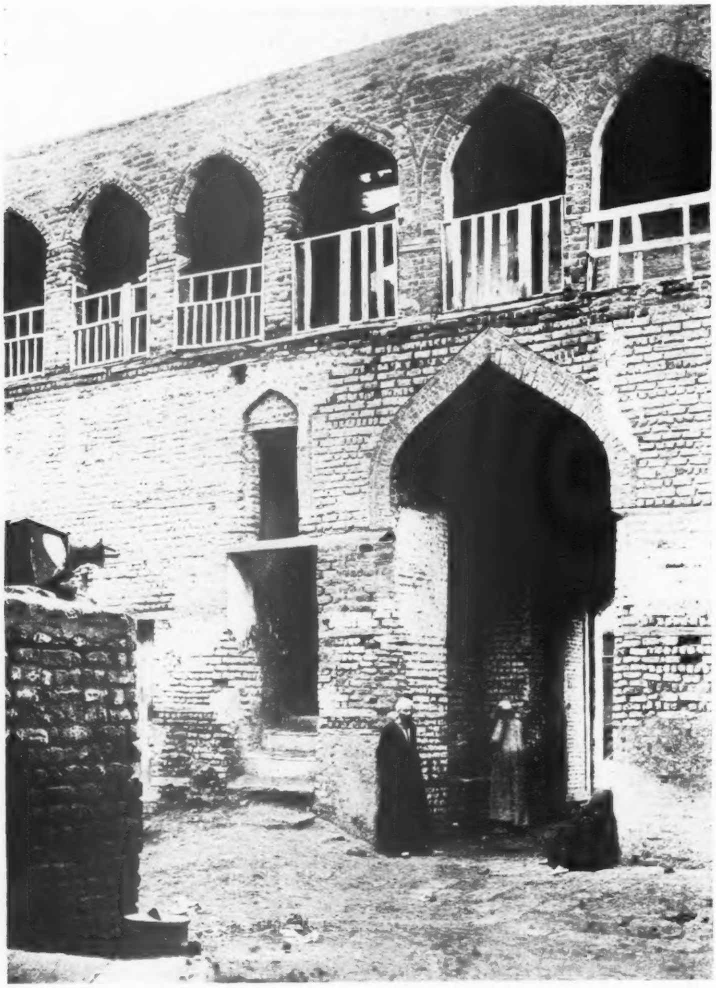
In native practice, the materials most generally used throughout Egypt are burnt brick and mud brick. Rubble stone is also employed, but not to the same extent. This material is used principally in Cairo and Alexandria owing to the existence near these towns of conveniently situated quarries.

The tendency of an Egyptian mason, if left to himself, when using rubble stone, is to break it into small pieces approaching the size of bricks. The native burnt brick is usually very rough; it is made of a mixture of mud and chopped straw cast in moulds, then built into clamps and burnt. The just proportion of width to length, necessary for bonding purposes, is not considered nor aimed at; nor is much attention paid to burning the bricks evenly. In Lower Egypt coal is used for burning; and in Upper Egypt the use of straw for this purpose is common.

The materials used for the composition of mortars are Nile mud, fat lime, the dust resulting from crushing burnt bricks (this dust is locally known as " homra "), sand, gypsum, and, lastly, a material known as " kosremil," which is the residue or ash of a fuel composed of street sweepings used for heating native baths. Various mixtures are used depending on the locality and on the riches or poverty of the building owner. For instance, in Tantah, and other towns situated far from the desert, sand is rarely used by the native Egyptian owing to its cost. In Cairo and Alexandria fat lime is easily obtainable, but in parts of Upper and Lower Egypt it would be out of the reach of many. Homra, the powder of crushed burnt bricks, is commonly used all over Egypt. Nile mud contains a high proportion of silica; and it is thought by some that its use with fat lime is explained by the formation of an insoluble silicate of lime, especially if the mortar is kept damp for a sufficient time. The setting or hardening of mud and lime mortar is, however, a very doubtful as well as a slow process. The lime made from the quarries of Egypt is, for the most part, fat lime, and there is practically none other used, if we except imported limes. The homra, or brick dust, already mentioned, is an artificial puzzolana, and its use with fat lime gives a certain hydraulicity to mortar. Damp is required if the best results are to be obtained from its use. This material is much used in foundation work; and also, occasionally, for elevation walling; but in the latter case, unless special precautions are taken to keep the masonry damp, the results of using homra are apt to be disappointing. Gypsum is used with ashlar work. A great deal of the ashlar of the mediæval mosques is set in a mortar into the composition of which gypsum enters; it is quick setting, expands on drying, and forms a tight joint preventing the escape of any mortar which may have turned to dust in the heart of the wall. The function fulfilled by kosremil, the ash of street sweepings, as an ingredient in mortar, is doubtful; it is thought by some that its presence adds something to the hydraulicity of the mortar; and, by others, that its virtue lies in the salts it contains, nitrates of soda and potassium. These salts keep the mortar, in which they find themselves, damp, thus preventing too quick drying in hot dry weather, an important point when fat lime and Nile mud form the other ingredients; for if the mortar dries too quickly, it crumbles to dust instead of hardening or setting. If this explanation is the true one, the kosremil may be said to act as a substitute for watering, or as a device to ensure that, if watering is neglected, the mortar will not dry too quickly. The following experience rather tends to confirm this view. A column of roughly shaped stones and mud mortar was being built in a remote district in Upper Egypt. The column was destined to bear part of the load of four arches, as well as a proportion of the weight of the pendentives and domes carried by

RUBBLE MASONRY, LOWER EGYPT.

the arches. In order to give the column the required power of resistance, it was, in the opinion of the local builders, necessary to add salt to the mortar. It is difficult to see what use the salt could be, unless it was to keep the mortar damp, and thus prevent crumbling, the result of too quick drying. The need for damp in walls which are built in mud mortar is further



FOURTEENTH-CENTURY WAKALA, MEHALA EL KUBRA, LOWER EGYPT.

Brickwork was originally pointed in gypsum and plastered. Of this little now remains.

exemplified by the objection on the part of many native builders to damp-proof courses where mud mortar is used in the superstructure.

If we except ashlar stone and mortar composed largely of gypsum, it is clear that neither are the materials above described as generally used by the natives for walling purposes, nor is the nature of the soil such as to make the construction of thin well bonded homogeneous walls a safe or practicable proceeding. The bricks are too rough and unequal to make a good

bond possible. The mortars possess no high degree of setting power. In demolishing Egyptian buildings it is found that the mortar in the heart of the walls is almost all turned to dust; unless, of course, gypsum has been used, but this is very rare owing to the expense. To build a 9-inch wall with such materials, and on such a soil, would be out of the question; and a 14-inch wall would be somewhat risky. The Egyptian builder does not attempt to do either, he builds a thick wall, rarely, if ever, less than half a metre thick.

If rubble stone is used, the masons work in pairs, one man on one side of the wall and his colleague on the other. Except that each proceeds at more or less the same pace, there is little connection between their work. There is no through bond. Practically two thin walls are constructed independently, and the space in between is filled with smaller stones and large masses of mortar. The mortar, if it is of mud, kosremil, and fat lime, and if it keeps fairly damp, hardens rather than sets. On the hardening of the mortar, more especially on the outside of the joints, the stability of the wall to a large extent depends; and, in order to fortify the outer joints and to render them as capable as possible of fulfilling their function of small retaining walls to any interior mortar which may have turned to powder instead of hardening, it is a common custom to bed, in the surface joints, small pieces of stone. When fat lime and sand mortar is used, the same practice is often followed, for it is recognised that this mortar sets only on the face, so that the face joint assumes a structural importance which it does not possess when a mortar capable of setting in the heart of the wall is used. If the wall is constructed of brick, hardly any more attention is paid to bond than in the case of a rubble-stone wall. The same mortars are used as those already described, the object of their use being solely to provide beds on which to place successive courses of brick. A more or less systematic appearance of bond is given to the face of a wall, but the application of the principle is not extended to the interior. Each course is constructed by laying bricks side by side about one centimetre apart; the vertical joints between the bricks are purposely left open; such as are not left open are only accidentally filled during the process of laying the horizontal beds. Native-built brick walls, like those in rubble, are rarely if ever less than half a metre in thickness. Walls, whether of brick or rubble, constructed in the manner and with the materials described, and standing upon a foundation bed liable to frequent movements, would of course soon collapse unless the entire absence of bond in the masonry itself were not by some means supplemented. The bond necessary for giving some degree of stability is provided by means of horizontal pieces of timber placed over and under all openings and forming lintels and cills. Ranges of these timbers are carried round the building; and similar ranges are bedded in the

BRICKWORK, MANFALUT, UPPER EGYPT.

walls at the levels of floors and roofs where they form plates to receive the joints; and other timbers are placed, apparently promiscuously, in any position independent of opening or levels of floors and roofs. The amount of timber judged necessary depends on the nature of the land built upon, more being used in buildings upon "made" soil, or on soil with an admixture of sand, than in those constructed on the black alluvium.

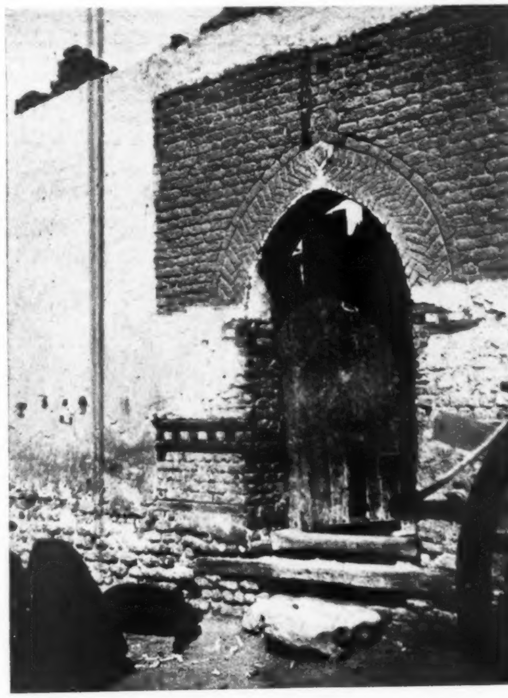
The surface of the wall is, when finished, provided with a rendering very generally composed of fat lime and sand. The object in view is not only to improve the appearance of the building, but to fulfil a structural need, that of protecting the outer joints of the masonry from the destructive influence of the sun and wind. The joints would, in the absence of the protective rendering, become cracked and gradually destroyed, or, as the native builder sometimes expresses it, the sun would "burn" the joints, and so prepare for the gradual collapse of the building owing to the escape of the dried and crumbled mortar in the interior of its walls, unless built so phenomenally thick as to be disproportioned to an ordinary building.

BUILDING, NEAR DAMIETTA, LOWER EGYPT.

The main characteristics of a wall such as that described appear to be its elasticity and the capacity it possesses to adapt itself, in a certain measure, to movements, both those in the foundation bed caused by the rise and fall of the subsoil water, and those in the superstructure itself caused by stresses set up by changes of temperature. The function of the timbers is to assist the bond; under opening they resist shearing stresses, acting as cills, and taking up the effects of unequal pressures which without them would in these positions be apt to cause cracks. In the case of a threatened settlement in the foundation bed, or in the masonry itself, between any two points in a length of wall, their action tends to be that of beams; and in the case of a threatened corner settlement, that of cantilevers; in both cases they help to transmit pressures to more solid portions of walling or foundation bed, and thus provide to some extent for the gradual automatic adjustment and distribution of pressures. In the best examples sufficient success is obtained to preclude any danger of sudden collapse. But the success does not extend to producing a building which will not, fairly soon after completion, begin to show signs of dilapidation, more especially in the case of houses in Lower Egypt. Small cracks will occur; the rendering will begin to fall from the loosely built walls, especially in houses of two stories or more, and from the face of the timbers which have been inserted to provide bond. Doors and windows will perhaps jam in their frames owing to slight masonry settlements; the walls to a height of about a metre above ground level will lose their rendering owing to the evaporation of the damp which, in the absence of any damp-proof course, has risen by capillary attraction in the wall, causing crystallisation at the surface of the wall of the salts contained in the materials of which it is built.

Such methods of construction give, it is clear, results unsuited to modern European requirements. To maintain the building in a state of repair considered essential by Europeans or

those influenced by European ideas is impossible; dust and dirt from falling plaster and from the continual entry of workmen either to replace it or to open jammed doors or windows, make the building uncomfortable, and the damp of the ground floor makes the lower rooms unhealthy. Further, the building is highly inflammable and, in consequence, not fit to house those who carry on business after night-important documents or to accommodate fall by artificial light.

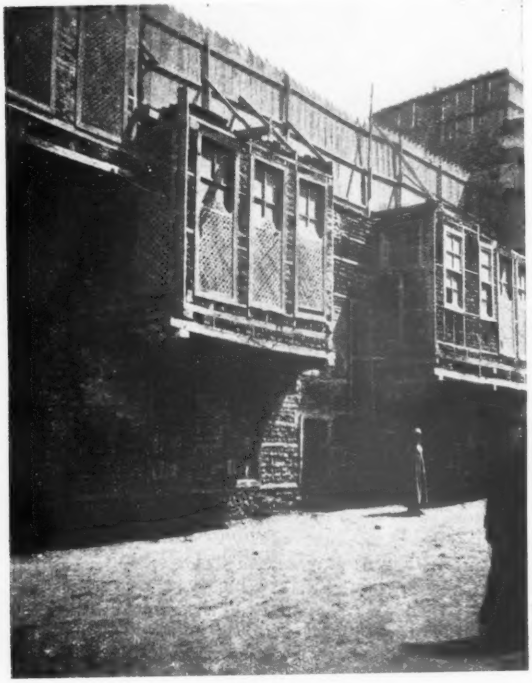

DOORWAY, NEAR MANFALUT.

It is not, then, to be wondered at that the changed conditions introduced by an increased inflow of foreigners have brought about some modifications to native Egyptian structural methods.

The defects of the ordinary Egyptian-built house being fairly obvious, it is not of course difficult to propose remedies. A more stable wall is needed; bond and imported hydraulic lime are therefore indicated. A drier wall could be ensured by the use of a damp-proof course of imported asphalt or bituminous sheeting. The foundation bed can be consolidated by various methods so as to reduce to a minimum the effects of the subsoil water level changes; or the foundations can be made of a rigid character capable of resisting the effects of movements. Imported steel joists can be used to replace wooden lintels over openings and wooden floors and roofs. Wooden beams built into the walls for bonding purposes can be omitted. By these means, a more solid, a healthier, and a more fire-resisting building can be erected. Such changes as these indicate the general effect of European influence on building in Egypt.

Up till a few years ago, it was a common practice to excavate the whole of the area to be covered by a building, and to lay down a thick raft of concrete. The concrete was laid in layers, and well rammed and watered. The ground was flooded before the concrete was laid, in order that any weak spots might show themselves. The raft of concrete has of late years been largely replaced by concrete piles. Holes about seventy-five centimetres across are punched in the ground by means of pointed weights dropped from a height. This results not only in forming a hollow shaft in the ground into which the concrete to form the pile is rammed, but also in compressing the whole of the area built over, and so in compacting the soil to a very marked extent. The ramming of the concrete into these hollow shafts causes the weight of the building to be distributed laterally, as well as vertically. The tops of the concrete piles, which are spaced about three metres apart, are connected by beams in reinforced concrete, and on these beams the walls are raised. This method has given, on the whole, satisfactory results. Broad spreading foundations of reinforced concrete have also given good results. How far time will confirm the wisdom of choosing such methods of construction is a matter for conjecture and speculation. In view, however, of the local difficulties in

getting trustworthy workmanship, it is difficult as yet to look with complete confidence on a system such as the reinforced concrete system, which depends to so great an extent on workmanship. Experience in Egypt has, however, brought, so far as I am aware, no evidence against its use either in foundations or as a means of constructing the beams which connect the head of concrete piles as just described. But it is clear that such a system should not be employed unless very special precautions in respect of supervision are taken. The desire to improve upon the loosely built and unsatisfactory native wall has brought about the use of mortars in which cements or imported hydraulic limes form the chief ingredients. Steel frame buildings are even beginning to make their appearance in Egypt, though it is too early to say with what result.



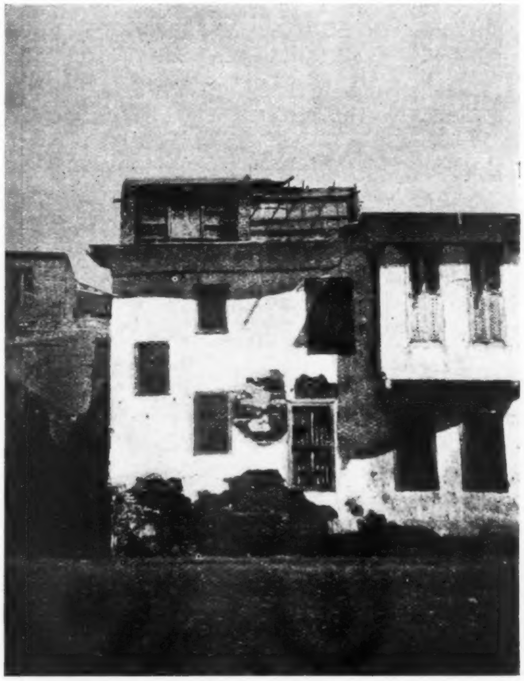
DAMIETTA.

Methods such as these have produced in Cairo and Alexandria a large number of buildings suitable for modern requirements. The introduction of new methods is by no means an easy task; nor is the result invariably successful. New methods bring with them the necessity for teaching a people of strongly conservative tendencies the meaning of things completely strange to them, and, occasionally, in direct opposition to their own traditions and practice. For this the foreign architect or builder must not only be equipped with a high degree of patience, but he must also be prepared to learn a good deal himself, more especially in view of the fact that his work is carried on in an environment the conditions of which he may not, at first, succeed in completely appreciating.

While it is very desirable, for reasons already given, to build with more rigidity than is possible by employing purely native methods and materials, it has been found that it is not always easy to determine the degree of rigidity which must not be exceeded. Almost as great inconvenience may, in certain circumstances, be caused by too rigidly built a wall or roof as by one which is too loosely put together. This point will be made clear by a few examples. Of the boundary walls enclosing various groups of buildings erected on a desert foundation near Cairo, some were built in bricks and cement mortar, others in bricks and local fat-lime mortar. Those built in cement mortar cracked vertically at intervals of from five to twenty metres throughout their length, while those built entirely in lime mortar were undamaged. It may be added that some walls were built in lime mortar, but with the top course of brick on edge set in cement mortar: wherever this was done the cracks occurred about five metres apart, the cracks extending only through the top three or four courses. Of two buildings near Cairo similar in every respect except as regards the combination of materials used, the one built in rubble stone and fat-lime mortar is uncracked, while the other built in well bonded brickwork and cement mortar cracked vertically at intervals. Thus the less rigid

structure gave a more satisfactory result than the more rigid; and the building constructed of a kind of rubble masonry which would, in England, be considered only fit for enclosure walls, and of mortar composed of sand and fat lime possessing no power of setting in the heart of the wall—in a word, a building which would at first sight appear to contain important structural defects—has stood better than the one which appeared to be in every way its superior, the bond being carefully attended to and the mortar capable of setting throughout the wall.

It is not possible to describe here in detail the result of the numerous experiments made recently in Egypt relating to expansion and elasticity of bricks and the temperature variation in walls; it can only be said that the general results of experiment and experience is to show that it is possible to overdo rigidity; or rather, perhaps, that rigid bodies of masonry must be designed, if cracks are to be avoided, so as to allow for movement, especially in the case of walls which are long in proportion to their height.


HOUSE IN DAMIETTA.

The necessity of allowing for movement may be further illustrated in the case of roofs. A roof constructed of steel joists and concrete, the concrete occupying the entire depth of the joists, was placed upon walls built in rubblestone work and fat-lime mortar. In a few months the building was found to be seriously cracked, and in a manner which removed all doubt as to the cause, which could not be attributed either to masonry or foundation settlements, but to the stresses set up by temperature changes. These changes caused horizontal cracks at the roof level and diagonal cracks at the corners of the building, showing that the expansion of the roof had tended to push the corners outwards. Another case of a building which suffered from temperature changes acting on the roof may be described. The method of construction was as follows. The roof, which rested on walls of a brick and a half thick, consisted of steel joists and concrete covered with bituminous sheeting, the latter being protected by a layer of concrete sloped to throw off rain-water and finished against a parapet wall a brick thick set in cement mortar. The building was rather long and narrow in plan, and the results of expansion were naturally more marked longitudinally. The parapet walls at the ends of the building were thrust outwards several centimetres, and horizontal cracks appeared at the roof level on the long sides of the building. These cracks showed clearly the cumulative result of the expansion, it being only slightly marked in the middle of the long side, and becoming increasingly so towards the ends. It would be possible to multiply examples of improvements which have failed; of good work which proved to be bad. There are several buildings in Egypt entirely constructed of reinforced concrete. It was found impossible in some of them to prevent the roofs cracking until recourse was had

to the expedient of protecting them from the sun by a second roof. There are two buildings in Cairo of reinforced concrete which are said to behave at certain times of the year in a highly curious manner. A movement or vibration takes place sufficient to move pictures on the walls; the buildings are not cracked, perhaps they would be more peaceful if they were. No explanation of these movements has been forthcoming, but it is thought that they certainly must be connected with temperature changes.

There has been, and is no doubt still, a tendency to neglect the effects of these changes and to design without reference to them. Modern materials and methods of construction make it possible to build so as to allow considerable intensity of stress to be safely exerted without fear of collapse, and wall and pier construction, thin and meagre when compared with former work, is now possible without danger, if the ordinary stresses caused by the weight of the building or by the loads it has to carry are alone allowed for. The work formerly done by a wall of rubble stone and fat-lime mortar 50 centimetres thick can now be done by a brick and cement mortar wall of half the thickness, or, to take a more extreme case, by a reinforced concrete wall of only a few centimetres thick. Again, the work done by a steel floor with jack arches can now be done by a thin slab of reinforced concrete. But such thin and rigid methods are not unattended by dangerous, or at least highly inconvenient, results in Egypt, owing to the temperature conditions; and it is a question yet to be answered how far the modern tendency towards thinness and homogeneity of construction are applicable in that country. This question can only be answered by continued experiment and research.


DOORWAY, AKHMEIN, UPPER EGYPT.

In Egypt there is, as yet, no established tradition capable of providing a suitable and complete guide when building for the fulfilment of modern needs. It is not, then, surprising that European builders have met with some experiences neither happy nor expected. The problem before them is of a twofold nature. How, on the one hand, to build so as to fulfil modern requirements in regard to stability, fire resistance, health, maintenance, and repair; and, on the other, to keep within the limits imposed by local physical or climatic conditions. To find the middle way, and to make a satisfactory harmony between local conditions and requirements of foreign origin, must be an object of the architect as well as of other workers in Egypt. Something may be learnt from a study of native practice; but, owing to the great differences in the manner of life followed by the inhabitants of houses built in accordance with that practice and that followed by most Europeans, such a study will not take us very far. Even the most careful and sympathetic examination of native methods will not do much more than provide an explanation as to why buildings which present every sign of decay and dilapidation do not collapse more often.

The subject of which I have attempted to give a brief outline is, of course, a very large

one. It has been possible to treat it in a general manner only; and for this purpose discussion has been restricted to the more clearly defined manifestations of native and European tendencies, without touching upon the Levantine borderland between the two, and to describing what appear to be, on the one hand, the broader principles which seem to have governed building in Egypt in the past and, on the other, the general lines of development brought about by European co-operation in the affairs of Egypt.

## DISCUSSION.

Mr. E. Guy Dawber, *Vice-President*, in the Chair.

Mr. R. WEIR SCHULTZ, rising at the invitation of the Chairman, said he had much pleasure in proposing a vote of thanks to Mr. Richmond for his excellent Paper, though he had no idea he should be asked to speak first as one who had an intimate knowledge of Egypt. It was true he had the pleasure of visiting Egypt over four years ago, and a most interesting experience it was. They were very fortunate in having Mr. Richmond to come and talk to them on Egyptian building methods, for, to his mind, there was no one better qualified than he to do so. It seemed only the other day, though it must be many years ago, that he had the pleasure of congratulating Mr. Richmond on the chance which had opened up to him of going out to Egypt to work with Mr. Somers Clarke on some of his investigations on Coptic monuments. After that, Mr. Richmond went to the Department for the repair of the Mosques, where they worked more than anywhere else, he thought, on the old traditional methods of the country. He must have gained very valuable experience there which must have been most useful to him afterwards. Later on he went to the War Office, where he had the opportunity of dealing with important buildings for barrack purposes. Then the Department of Public Works, knowing—for once—a good man when they saw him, secured his services, and there he had been, and is now, having risen to the top of the tree as Director of Public Buildings for Egypt. The Government of Egypt were to be congratulated on having such a capable and able servant. When he (Mr. Schultz) was in Egypt, he had the opportunity of seeing a number of the works which had been executed under Mr. Richmond's direction, and he must say that in every case the buildings were direct, straightforward, suitable buildings, done with great care, and in a manner suited to the purpose for which they were intended. The local conditions also had been as far as possible utilised. There was no attempt to copy forms which were of no use; no attempt to imitate the old patterns where such would have been out of place. It was a pity Mr. Richmond had not shown them that evening some of the modern buildings with which he had been connected. One of the great difficulties, as Mr. Richmond had said, was the putting up of buildings for Europeans by native workmen who did not understand the conditions under which Europeans lived. He, in company with Mr. Richmond's then colleague, Mr. Rodeck, went to see a house, a most delightful building, which Mr. Richmond had then just built for the Inspector of Antiquities at Sakhara. It was built by native workmen. They went by boat up the Nile, and got stranded on various sand-banks, and had several adventures. Night came on, and they had to anchor and sleep in the boat. Next morning they hired mules and went across country, sent their man to fetch provisions, and had a delightful native lunch in out-buildings near by. After that, the fun commenced: they went to inspect the building. There were most violent altercations, and his companion had a very bad time of it. He mentioned this to show the difficulties which must constantly occur in getting local people to work on methods which they did not quite understand. They had to suffer from that even in England very often. It was a pity Mr. Richmond had not time to tell them something more about native craftsmanship in woodwork, metalwork, plasterwork, &c., which they still did in Egypt. The craftsman in Egypt was still very much alive, and the tradition remained in many of the crafts. He spoke with great diffidence, because he was in the country for only a few weeks; and although he made an endeavour to see as much as possible of their methods, he could only see them rather superficially. He heard some time after his return that there was a movement to form a Department for Technical Education in Egypt, and they were looking for a good man in this country to go out and show the Egyptians how to become craftsmen. It was a pity they did not get some one in the country who had knowledge of the native methods, and who would try to perpetuate the good points about the old traditions. A very able man went out, a man imbued with European ideas about these matters, and he sent for certain models which had been made in a Technical School in London to serve as examples for the Egyptian craftsmen. These models were sent, but, he understood, the climate was too much for them, and they fell to pieces! In the most excellent museum at Cairo, where he spent many happy days, there were numerous beautiful examples of Arab craftsmanship; it was a pity those examples were not better known in this country. He should like to have said a good

deal more, but owing to the lateness of the hour he must refrain. He hoped Mr. Richmond would again, before long, come and talk to them on this interesting subject.

Professor FLINDERS PETRIE, in seconding the vote of thanks, said Mr. Richmond's Paper was interesting in several directions. It was extremely interesting as explaining in many ways the ancient craftsmanship and the methods which had been, perhaps, more before him (Professor Petrie) than other aspects. Again, it was extremely interesting as showing the sympathetic manner in which the necessities of modern times had been met. We had not to deal with European workmen there; very often we had not to deal with people who were capable of reading a plan, but we had to deal with them as they stood and the methods which were adapted to the majority of them. And that was a very limited factor, as he knew himself. The Paper was also interesting as showing the conflict of Western methods and Eastern methods, and how necessary it was to understand the reason of a thing before one criticised it and pulled it to pieces. In some respects he could say something about construction, because for a good part of his life he had set up mud-brick huts in a primitive manner, perhaps more than any other European had done, because they were wanted only for temporary purposes. So he had observed the nature of the material, and the necessities which had led the Egyptian into the line into which he had fallen. In Upper Egypt, they were told, the condition of the houses was much better than in Lower Egypt. He did not think that this was only a matter of climate, but of people. The Delta was Arab in its population. Upper Egypt was Coptic, and in many towns entirely Coptic. The town in Coptic Egypt was very different from the Mohammedan town. The streets were straight and well swept; one could see the people sitting at their doors, and the women doing their work; the whole thing, in fact, had a much more Western air than anything to be seen in a Mohammedan village. That was all reflected in the conditions of their buildings. He hoped therefore that a little credit would be given to the people as well as to the climate. With regard to the disadvantage of a desert site, he remembered that a number of houses were put on a desert site near Cairo, a charming open desert, healthy and with nothing to fear, as dry as a bone. They were built in an extremely wide watercourse, which drained down from the mountains twenty miles away. This lasted very well for two or three years; but one day there was a black cloud over the mountains, and shortly afterwards there were two feet of water in that site, and in a short time the whole of the houses were reduced to pianos, pots and pans, and wreckage. So in Egypt the surroundings must be looked to as well as the foundations. Wall facings had been referred to, and that is, for common mud-brick work, the greater part of the strength of the wall. After a mud-brick wall has been built, it can be set swinging several inches to and fro, and this can only be stopped by putting on a coating of mud-facing on each side, which acts as two sides of a girder, preventing the walls bending sideways. The stiffness depends on this coating of mud. He examined some of the most permanent coats of mud, those which were most successful, as he wanted to see the real structure. He found that the best mud-facing consisted of sand, with just enough mud to back each grain and thus to fill up the interstices of the sand. The grains were all in contact. The wall face was continuous, and when there was weathering of the wall the little bit of mud which backed every grain was protected by the grain of sand outside. It might get wet, but the mud still held the grain of sand intact. The mud might be wet or dry, it equally held the grains of sand. It was that form of mud mortar which was always to be aimed at. The Egyptian builder experimented for this. He made samples, putting a certain amount of mud and sand, and if it cracked it was no good; and he made another sample, until he got one which showed no cracks in drying. It showed how much care was required to carry out with success building work with native materials, and how successful those methods may be. These plaster walls would stand an enormous amount of rain, and immediately on that the hottest sun, so that it dried in half an hour. The elasticity of the walls had been referred to. The ancient Egyptian went further than the modern in that respect, because it was a custom in the XIIth Dynasty to build walls in a corrugated form, and thus there was no difficulty about the lateral contraction of the wall. They got as much stiffness as could be got for a reasonable amount of brickwork, and they got over the whole difficulty of contraction and expansion of the wall. The wall would get curved more or less as the foundations sank one way or the other; and they got elasticity and stiffness also. Another point to be noted is that when building in soft material like mud brick, with a low crushing-point, the flat arch would not do at all, because the pressure was so great. Therefore the Egyptian always built with a very high parabolic arch with a very small curve in the lower part of the sides, and rounded over with a small arch at the top. The Egyptian avoided the crushing strain caused by the flat arch. He had observed modern European builders miss this point; they turned round arches and were surprised they had to make them double the thickness that the Egyptian did in order to save crushing. With this material it was necessary to work with a high parabolic arch. With regard to the use of timber in the walls, that was a very ancient custom. Before the time of the Pyramids he had found large beams of

wood introduced, running diagonally through the materials, binding them together. Mr. Richmond had not mentioned the difficulty due to white ants. He believed they had been kept out of Alexandria, but in other parts he had known buildings riddled with white ants, particularly in Upper Egypt, where sometimes villages had been deserted owing to the walls being eaten out with ants. The people had had to move away and build elsewhere and start afresh. For practical purposes he soon found that petroleum oil would keep them away. One point which might be considered was the nuisance of salt working out all round the footings of the building and disfiguring the building. Salt only resided in the surface of the soil; there was but a small amount of salt, but it was found on the surface, where it accumulated owing to continual evaporation. Water might contain 1 in 10,000 of salt, and by the time a thousand volumes of water had come up and been evaporated they would have one-tenth of a volume of salt on the ground, and it lay on the surface. In ancient sites, blocks of granite were split into component crystals if they had been within two or three inches of the surface. And that suggests that while it is desirable in native work to keep the wall damp, as it is unless European cements are adopted, and if it is wished to maintain that general plasticity, it might be possible to do much good by putting a damp course not through the wall, but on the face of the wall, so that it can take up the moisture from the depths, while the salt from the surface is prevented from entering. It might be worth while to face the foundations to six inches above the ground with a damp-proof facing on each side for this purpose. He had seen walls of buildings which were lapped round at their bases by the Nile and were not affected by salt, and he had seen buildings which were two or three feet above Nile-level get a maximum of salt. Those were a few practical points which occurred to him on hearing this very interesting Paper, and he hoped that out of his great experience Mr. Richmond would give many more Papers dealing with the other questions which had been raised, and with details of the adaptation of West to East, which was always so interesting.

Mr. SOMERS CLARKE, F.S.A., said the Paper had been a great pleasure to him, because Mr. Richmond and himself had so often talked over these subjects, and now he saw them put into form. He wished to congratulate themselves and Mr. Richmond and the Egyptian Government on the fact that in Mr. Richmond they found a European who went out to Egypt but did not do what he regretted to say so many Europeans did—that is to say, think that all natives, as they called them, were more or less idiots, and that all their methods were foolish. It must be remembered that these people were highly civilised when we in this country were blue-painted savages. They had a long tradition behind them, not only traditions of the ancient methods of building, many of which existed to this day. Mr. Richmond had very clearly shown that a great number of things which we thought so clever and which were very suitable to our country were by no means so suitable when they were transported to Egypt. Mr. Richmond had spoken of masses of material cracking. There was one point he might venture to add to what had been said. He had not referred to the extreme alteration made in a mass of wall by dryness; a slow process. In an ordinary wall built of mud bricks and solidly constructed, a native thought that for a 75-centimetre wall one must allow two years at a high temperature to dry, though the thermometer was often above 100° F. It was evident that movement went on long after two years. It would be found that with a considerable length of wall and five or six windows at intervals of eight or ten feet, there was almost sure to come a vertical crack over the crown of each window; and he knew one case in which there were many of these. The wall yielded to contraction at the weakest point, which was over each window. He knew many buildings set upon an immovable rock foundation, yet in which these movements took place. The dryness contracted it, and it went on contracting. At first those who did not understand it considered that the building was in danger, but he thought the cracks were a safeguard. Mr. Richmond said that the ancient Egyptians were somewhat negligent of foundations, and he implied that they were so all through time, but he did not agree with him. From the XXVIth Dynasty, and when more European, chiefly Greek, influences came on, they began to make respectable foundations. There were some buildings in which there was more stone underneath the building than there was used in its construction; six or seven courses of masonry which bed two feet deep under the structure standing upon it. He might further remark that the ancients must have been conscious of the necessity of allowing for movement, for we never find such a thing as absolute rigidity. There were exceptions in the outer skin of the Great Pyramid. Those were of stones closely set, equal to the masonry of the Parthenon. But, behind that, the joints were very wide and were filled with mortar. And the high walls of the Temples were the same. There was, in fact, abundance of room for these masses of stone to expand and contract as the heat made necessary. But he would call attention to the curious effect which we get as a result of expansion and contraction. Take an architrave which has stood a couple of thousand years; naturally it has been exposed to the greatest changes of temperature. While the top of the stone beam is in a state of compression, the lower part is in strain; and we find the beams break not through the middle, but the lower edge chips off, forming a

sort of arch. The strain below causes this material to chip off until it assumes the form of a flat arch; and then it breaks through, and falls together, and so it continues as a flat arch of two stones.

Mr. R. PHENE SPIERS, F.S.A. [*F.*], said that his experience in Egypt was of a different nature, and was connected with the aspect only and not with the construction of Egyptian buildings; but he had been struck, on hearing the Paper, by the fact that M. Choisy, in making studies in the curvatures in walls and trying to account for these curves, must have had in his mind some of these effects. The walls which he describes were often made with gaps, which M. Choisy thought were due to the expansion which Mr. Richmond described. It had been of the greatest interest to him to hear the Paper, and it would be of great interest to go through it in the light of what M. Choisy said, and see to what extent M. Choisy was justified in the conclusions at which he arrived. On the present occasion one was glad to be able to congratulate the Egyptian Government on the fact that they had in Mr. Richmond someone who would take care of the ancient monuments in Cairo. When he (Mr. Spiers) was there in 1866 the buildings were left to take care of themselves; and if stones fell into the street, many more were removed from the building to prevent them falling off and causing accidents. In that way the buildings had been destroyed. He remembered one day he had been drawing on the top of a mosque, and on the second day they refused to allow him to go into the place. But he dodged the keeper and managed to get again on to the roof. Next day he expected the same difficulty, but he was allowed to pass, and he thought the favour was due to his perseverance. But when he got there he found that the staircase had been taken down to the extent of ten feet, so that he could not go up again!

The CHAIRMAN, in putting the vote of thanks, said the Meeting would agree that they had had an extremely interesting and instructive Paper. He, personally, had enjoyed it very much. And, in addition to the Paper, they had had a most gratifying discussion, by authorities who know the country and could speak with knowledge. The Paper showed an enormous amount of research on Mr. Richmond's part, and doubtless he would like to answer some of the questions put by the various speakers.

Mr. RICHMOND, responding to the vote of thanks, remarked that Professor Petrie had made some very interesting observations on the desirability of having surface vertical damp-proof courses. They had tried that in one or two old buildings in order to endeavour to preserve them a little longer; and, so far as their experience had gone, it had been a great success. They had put a layer of bituminous sheeting about 1 metre 20 centimetres up the wall, and built against it a half-brick wall set in cement mortar. This, as Professor Petrie said, prevented evaporation, and consequently prevented the crystallisation of the salts. With regard to what Mr. Somers Clarke had said about foundations of ancient Egyptian buildings, the point he (Mr. Richmond) had in his mind was that there was no evidence to lead them to believe that the Egyptians ever went down to the level of permanent saturation, which would appear to give the best chances of solidity and would provide a foundation more in agreement with the massive character of the superstructure. But, of course, it was futile to criticise the foundations of buildings which had been standing thousands of years. He wished also to explain that his position, referred to by Mr. Phené Spiers, as regards the preservation of the Arab monuments had been a subordinate one. He had had but a modest share in the work. He had enjoyed the privilege some fifteen years ago of working for a few years under Herz Bey, the very capable Chief Architect to the Committee for the Preservation of Arab Monuments, to whose care and knowledge the present satisfactory condition of the Saracenic monuments of Cairo was due.

## LINCOLN CATHEDRAL: THE NEW READING.

By John Bilson [*F.*], F.S.A.

I have read very carefully Mr. Watkins' communication in the last number of the Journal (pp. 510–518). As it seems to me that there is nothing in it which affects the conclusions adverse to his theory set forth in my previous communication (pp. 464–475), I should not have trespassed further on the space of the Journal, had it not been that Mr. Watkins either misunderstands or questions the accuracy of some of my statements of fact. It is very desirable that there should be no confusion as to the actually existing facts, and I wish therefore to add a few remarks on these and a few other points arising out of his last communication, without again going over the whole ground.

1. Mr. Watkins says (p. 515) that I questioned the accuracy of his plan and the basis on which it was set out—"because he thinks it does not exactly fit in with every feature and minute detail of the plan and dimensions he has himself taken." This is not so. What I wrote (pp. 465–6) was something entirely different. In support of their view that the choir aisles were not originally intended to be vaulted, Mr. Bond and Mr. Watkins asserted that the vaulting shafts did not centre with the buttresses (an erroneous statement which Mr. Watkins repeats on p. 516), and that the setting-out line did not give the centre of the present aisle walls, but the centre of the aisle walls as they would be were the present trefoiled arcading removed (p. 38). I expressed no opinion one way or the other on Mr. Watkins' method of setting-out. What I said was that their inference from their setting-out line was not justified by the facts, and, in proof of this conclusion, I gave the dimensions on the line of the piers which have been least altered. Mr. Watkins seems to imagine that these measurements were taken on the line of the western piers of the eastern crossing, and he says (p. 516) that he is afraid that I "had forgotten or failed to notice" that the northern pier was entirely rebuilt when the Angel choir was erected. As there is no double arcade to measure to at this point, I should have thought that it would have been obvious that the measurements which I gave were not taken on this line, even if I had not said quite clearly (p. 466) that they were taken on the line of "the first pair of piers west of the eastern crossing," which is Mr. Watkins' "third pier counting from the great tower." I pointed out that, as the difference between the two centre-lines of the aisle wall, with and without the arcade which they suppose to have been a later addition, was only some $4\frac{1}{2}$ inches (it may be 5 inches), their inference would only be justified if the premisses were accurate within very narrow limits. Mr. Watkins' measurement, taken on the line of the same pair of piers, of 43 feet 3 inches for the main span is 7 inches wrong, and his total width of 85 feet 11 inches is, I think, more than 1 foot wrong.* The only importance which I attach to the precise measurements is that they afford the means of testing the inference built upon them, and this, I repeat, is not justified by the facts.

2. Mr. Watkins says that there must be some mistake in my statement that the bases of the choir vaulting shafts are "bedded in the old Norman wall below the stall floors" (p. 517). My statement was confined to one pier (p. 468, col. 1, note ‡), which was the only one which I had then seen,† and the existing plinth of the vaulting shaft on the choir face of this pier is, as I said, built upon (not "bedded in") the wall-foundation of the eleventh-century choir,‡ as also is the plinth of the shaft on the next pier eastward. The third pier stands entirely clear of the early foundations.§ This point, however, is not very material in itself, but what is material is that there is nothing to indicate that the rubble foundation has been "cut into" to receive these plinths (as the authors stated on p. 38), and that there is nothing whatever to indicate that these plinths are not of the date of the piers themselves.‖

3. Mr. Watkins agrees that the shafts on the face of the main piers on the west side of the eastern transepts are original, but he says that "they were not

* Since the publication of Mr. Watkins' last communication, I have remeasured the widths on this line. The width of the main span, from centre to centre of piers, is 43 feet 10 inches (as I stated), measured on the west face of the piers over the canopies of the choir stalls. The half-width of the pier to outside of shaft is 2 feet $2\frac{1}{4}$ inches to 2 feet $2\frac{1}{2}$ inches. The width of the north aisle, from the face of the pier shaft to the face of the inner arcade, is 18 feet $3\frac{1}{4}$ inches, and of the south aisle 18 feet. The thickness of the aisle wall, including only the inner arcade, is 2 feet 7 inches to 2 feet 8 inches. There is room for some small discrepancy in these widths across the aisle, for the thicknesses of the aisle walls can only be measured through the windows.

† I have since found that there is another means of access to these plinths of which I was not then aware, and I have now examined the three which remain, to the three piers on the north side of the choir.

‡ The southern face of the eleventh-century wall-foundation actually exists as far westward as the centre of this pier.

§ It is not possible, without removing the present grouted rubble surface, to say precisely where the eleventh-century foundation ends and the later foundation begins. In the recent excavations, where it was found that eleventh-century foundations had been extended in the thirteenth century, it was not possible to distinguish any join in the rubble.

‖ With regard to the choir vaulting shafts, I pointed out that the plan of the pier, with its four cardinal faces hollowed out, was obviously designed for four shafts. Mr. Watkins (p. 516) adheres to his contention that there were only three shafts originally, thus making the plan quite irrational, and his reason is curious. There could not have been a fourth shaft, because in the absence of vaulting there would have been nothing for it to support. That is, the conclusion which he seeks to establish (which I hold to be entirely erroneous) is urged as a proof that the facts must be—something that accords with his conclusion. The plan of the pier was correctly interpreted by Professor C. H. Moore in his *Gothic Architecture* (2nd edition, 1899), pp. 204–5, and fig. 111.

constructed for vault shafts but for roof shafts" (p. 517), and he says that "they have been spliced (*sic*) and lengthened just below the abaci of the pier capitals to which they are attached, and just to the depth of the other capitals of the smaller shafts which cluster round the piers." But in the shaft in the north-east transept the short length of shaft is decidedly less in height than the adjoining capital, and the making-out of Purbeck shafts with a short length of this kind can be seen in many places where there is no question of roof shaft, vault shaft, or adjoining capital. Mr. Watkins says that these shafts "were, of course, continued down to the floor, as all the other roof shafts appear to have been where unobstructed by triforium arches or windows or other openings." The positions of these shafts are indicated at C on my outline plan of the south-east transept, and by the short dotted line in the corresponding position on the plan of the north-east transept (fig. 2, p. 469). It will be seen that each of these shafts, if continued upwards as a roof shaft, would pass in front of the middle of one of the "pigeon-holes" which Mr. Watkins supposes to have been triforium openings,* and that the shaft in the south-east transept, if continued in this manner, would also pass in front of the middle of the arched recess above the vault which Mr. Watkins believes to have been a clearstory window.† Nevertheless, and in spite of my fig. 2 (p. 469), Mr. Watkins writes that, with regard to the choir transepts, there seems to him "no difficulty whatever, and nothing that could prevent our suggestion that a former triforium existed before the present one was constructed" (p. 517). It would be interesting to see his restoration of the internal elevations of the eastern transepts.

It is unnecessary to emphasise here the decisive proofs, which I discussed in my former communication, that this supposed reconstruction of the triforium of the choir never took place, but I cannot pass without comment the way in which Mr. Watkins meets one of these proofs. Mr. Bond and he stated in their *Notes* (p. 46) that the apexes of the "pigeon-holes," wide and narrow, were at the same level, and they seem to be so shown in Mr. Watkins' drawing of April 22 of the "original elevation" (fig. 18, p. 511). The wide "pigeon-holes" behind the vaulting shafts in fact step down with the floor of the clearstory passage, and Mr. Bond and Mr. Watkins gave quite correctly the reason why the passage floor is stepped down—to give headway under the abutment of the vault (p. 46). Mr. Watkins now says (p. 517) that "further investigation" has convinced him that the single openings in the narrower bays (of the supposed triforium) were lower than the grouped openings in the wider bays—not because they followed the stepped floor under the abutment of the vault, but in order to "heighten the expression of the larger openings and to avoid an otherwise monotonous interior." But he will have to lower the springing lines of these wider arches as well,* before his fig. 18 will agree with the existing facts.

* That in the south-east transept is shown at C on my fig. 4, ii. p. 472.

† At C on my fig. 5, p. 473.

4. Mr. Watkins does not attempt to meet the difficulties which his reconstruction theory involves in the great transepts. In a previous letter (p. 306) he stated as a proof that the "pigeon-holes" were never intended to be relieving arches, "that they were omitted from the end bays of the central transepts from the very first, for the simple reason that these bays were not completed until after it was decided to vault the church, and the lancet arcading of the triforium was therefore not required, nor was it ever built there." I have already called attention to this statement,† but, as Mr. Watkins has not taken the opportunity of explaining or correcting it, I must point out that the presence of arched openings in the double bay on the east side of each transept, next to the piers of the great crossing, affords yet another absolutely decisive proof against his triforium theory. In the arcade on the inner (or transept) face of the clearstory of each of these double bays, the jamb next the crossing, the central pier, and both arches, were rebuilt after the fall of the tower in 1237 (or 1239). In the outer wall of the clearstory immediately above the floor of the passage, there is an arched opening (or "pigeon-hole") in each half of these bays, though they are now walled up. According to the authors' theory, these are the arched heads of their supposed original triforium. But they are found *in the wall which was rebuilt after the fall of the tower.*‡

5. With regard to the arched recesses on the inside of the clearstory walls of the choir, above the springings of the vault, I stated that there was a difference of 1 foot 11½ inches between the levels of the springings of the arches of the windows and external arcade and that of the arched recess in the bay which I had measured, and I added that this fact proved that these recesses could never have formed part of the same composition as the windows and external arcade (p. 474). Mr. Watkins says (pp. 517–8) that there seems to be an error here, and that it is impossible that such a difference should exist, for the strange reason that "the radius of the two arches *appears to be* identical," and for another reason which seems still more strange; how a comparison of my *plan* (fig. 6, p. 474), which of course shows no heights, with Mr. Sharpe's *elevation* (fig. 4, p. 41), which does not show the internal recesses at all, can prove anything whatever about

* See p. 471 ante.

† P. 470, note ‡.

‡ I am certain of this as regards the north transept, and I believe it is the same in the south transept. The two blocked openings exist in the corresponding double bay of the south transept, and the corresponding parts of the inner arcade have been rebuilt after the fall of the tower, but I have not examined the outer wall on this side from the passage itself.

the relative heights of the arch springings, I cannot conceive. The relative positions of the windows and external arcade and of the internal recess in the bay of which I have already given a plan are shown on the outline elevation, fig. 7.* The difference of the springing levels *is* 1 foot 11½ inches, and this has been verified by independent measurement. Mr. Watkins will have to revise his fig. 19 (p. 511), before it will accord with the existing facts.

6. My surmise that the "new reading" would involve the supposition of changes in the clearstories as drastic and amazing as anything else that the authors' hypothesis suggested has been amply confirmed by Mr. Watkins' description of the reconstruction which he imagines to have taken place. According to him, the whole clearstory wall was originally built of the full thickness which it now shows below the vault, and it was subsequently thinned by the removal of a thickness of 11 inches † on each side of the church, from its internal face. This could not be merely a question of the "stripping" of window dressings, as Mr. Watkins suggests, but it must have involved the refacing of the whole internal face of the clearstory wall above the vault, which is in rubble in the north-east transept and in part of the south-east transept, and in ashlar elsewhere in this transept and in the choir. Such an operation is quite incredible, and is absolutely inconsistent with the existing facts. Mr. Watkins, indeed, says that "there are some rough places in the wall still remaining from where these arches were torn away, as it were, round the upper parts of the vaults that have never been refaced nor made good" (p. 513). After careful search, I have completely failed to find any such place, nor indeed is it easy to understand why any such should exist, for the cutting-away of a thickness of 11 inches from the face must inevitably have involved complete refacing, unless the walls had been left rough when cut away, which is not the case. Mr. Watkins asks why, unless his theory is true, did the builders put any ashlar work at all above these vaults. But he has stated that the nave was intended to be vaulted from the first, and the clearstory walls of the nave above the vaults are faced internally with ashlar. Although Mr. Watkins asserts that there was no rebuilding at all either inside or outside (p. 513),‡ what his clearstory theory involves, as he explains it, is the "stripping" of a thickness of 11 inches from the internal faces, the walling-up of the windows over the main piers and the substitution of the external arcade of two arches, the alteration of the side arches of the internal arcade, and the lowering of the clearstory floor and string by some feet, with the refacing of the wall below the windows—all this was done, and that too without leaving any marked indications of the truly marvellous transformation which had been effected.

There is, however, another proof, which has not yet been noticed, that these arched recesses above the vaults are not blocked clearstory windows. On each side of the angle between the south-east transept and the choir there is an arched recess of the same description as the others, except that these two recesses do not extend downwards below the springings of the arches. I give their precise dimensions below,* so that anyone can plot them in plan and elevation for himself. The apexes of their sharply pointed arches are at about the same level as those of the adjoining recesses, the arches are of the same face-width, and their masonry is of precisely the same character, with precisely the same description of tooling. They are placed close to the angle, and behind each recess is the full length of the wall which abuts at right angles to the wall in which each of them is found. It is

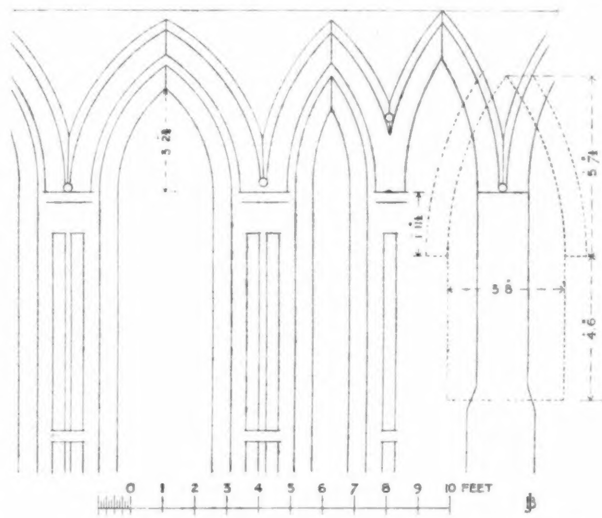



FIG. 7.—OUTLINE ELEVATION OF CHOIR CLEARSTORY, THIRD BAY FROM EASTERN CROSSING.

* This outline elevation, plotted from actual measurement, is only intended to show these precise relative positions, and does not show the "ventilators."

† In the bay of the choir which I measured, I made the difference of thickness to be 9 inches.

‡ Mr. Watkins, however, himself speaks of "rebuilding" more than once in the later part of his last communication (p. 518).

* Each of these recesses is 2 feet 2¼ inches wide at the sill, 3 feet 4½ inches in height from the sill or springing of the arch to the arch-soffit at the apex, and 1 foot 2½ inches and 1 foot 3¼ inches in depth respectively. The measurement from the angle of the wall to the nearer side of each recess is 1 foot 8 inches, and to the further side 3 feet 10¼ inches. The two walls which meet at right angles at this angle are 3 feet 8½-8¾ inches in thickness.

obvious, therefore, that they can never have been blocked windows,* nor indeed anything but what they now are—arched recesses, evidently designed to lighten the structure.

The idea that Lincoln was designed, and built so far as its eastern parts are concerned, as a wood-ceiled church is one which is (as Professor C. H. Moore truly said years ago) unsupported by evidence, and contradicted by the character of the entire system. In fact, Messrs. Bond and Watkins' first impression that the reconstruction of the triforiums and clearstories which they have put forward was "an amazing thing," which seemed to them for a long time to be "wildly improbable," was far truer than their second thoughts. This imaginary reconstruction was recognised at the outset as inherently improbable by Professor Lethaby and Mr. John Codd. It is emphatically contradicted by some of the very facts which were believed by its authors to support it; the more closely it is examined, the more impossible it is seen to be; and it is entirely opposed by the clearest possible evidence in the structure itself.

* It is hardly necessary to point out their identity of character with the arched recesses above the floor of the clearstory passages, behind the vault-springings.

## REVIEWS.

### Mr. WATSON'S BUILDING STONES.

*British and Foreign Building Stones: a Descriptive Catalogue of the Specimens in the Sedgwick Museum, Cambridge. By John Watson. 8o. Cambridge,* 1910.

*British and Foreign Building Stones* is the simple title of a new and important work by John Watson. Primarily the work (published by the Cambridge University Press, price 3*s.*) is a descriptive catalogue of the extensive collection of building stones in the Sedgwick Museum at Cambridge. In this descriptive catalogue the chemical properties of most of the specimens are given, and the weight per cubic feet as well as the crushing weights. The credit for the formation of this collection, probably the finest in the world, comprising as it does considerably over a thousand specimens, is due to Mr. Watson, and it is gratifying to note that Cambridge University has conferred a well deserved Honorary M.A. degree upon him in recognition of his labours.

The book is one which should appeal especially to architects. It is in the judicious selection of a suitable building stone and its proper application that the lasting power or durability of the structures is to be attained. If architects in the past had had this information now so carefully and scientifically compiled by Watson, there is no doubt that many buildings of great architectural importance would have been preserved to us in a more perfect condition than we find them to-day.

It is often stated that neither the paper nor the ink of modern books will last one hundred years, and what is true of our literature is in a large measure true of our buildings. The importance therefore of the subject dealt with by Watson cannot easily be over-rated. As an example, he directs attention to the colleges at Oxford: those erected in the thirteenth, fourteenth, and fifteenth centuries, when the Taynton Stone of the great oolites of Oxfordshire was used, are now in a better state of preservation, the mouldings being sharper and less weathered, than those buildings erected in the seventeenth, eighteenth, and nineteenth centuries which were built with stone from the Upper Corallion beds quarried at Headington Hill near Oxford.

This work, taken in conjunction with the extensive collection of building stones in the Sedgwick Museum, should prove a sufficient guide to architects in the important question of the selection of a suitable building stone. Architects should be grateful to one who, though not an architect himself, has patiently laboured in the raw material, and finally, and ungrudgingly, given to them the benefit of his research. Again, the author has sought for, and found, the quarries which supplied the stone to many of the cathedrals and important buildings in this country. This in itself is a useful work, for, in the absence of documentary evidence, it has entailed an immense amount of investigation.

Finally, it is interesting to know that the University of Cambridge has recently, for the first time in the history of the ancient universities of England, put into its official curriculum a course of training in the history and theory of architecture and the allied arts. The benefit of the training which is now being afforded at Cambridge in this direction will be greatly enhanced by the fact that the University is the possessor of this unique collection of building stones.

We congratulate John Watson on his successful work and on receiving the honorary distinction which has so recently been conferred upon him. We also congratulate the University of Cambridge for having inaugurated the course of architectural training in its curriculum, and on being the possessor of Watson's collection of building stones.

George Hubbard, F.S.A. [*F.*].

## PHOTOGRAPHS OF BUILDING STONES.

Visitors to the Library should not fail to look through a recent important acquisition which the Institute owes to the Science Standing Committee, a volume, or rather album, made up of a remarkably fine series of carefully mounted photographs, representing thin slices of building stones magnified thirty diameters, with explanations and descriptive notes. The explanatory and descriptive parts of this unique work are in manuscript—a beautiful specimen of the penman's art—and the whole has been most tastefully arranged under the super-

vision of Mr. Matt. Garbutt and Mr. Alan E. Munby, respectively Vice-Chairman and Hon. Secretary of the Science Committee, assisted by Mr. Howe, of the Geological Museum. The origin and purpose of the work are thus explained in a Preface by Messrs. Garbutt and Munby :—

The Museum of Practical Geology, Jermyn Street, W., has recently undertaken the preparation of a valuable collection of rock sections, which include the most important building stones used in this country.

Through the medium of the Board of Education photographs of these sections are now obtainable by the public, and it was resolved by the R.I.B.A. Standing Committee on Science (then under the Chairmanship of Mr. Max Clarke) to recommend the purchase of a series of such photographs, to be mounted in a book, as an addition to the Library. The Council having made the necessary grant, the Hon. Secretaries of the Science Committee were instructed to select the illustrations and to prepare the volume.

The photographs, which are taken direct from thin slices of the actual stones magnified thirty diameters, and which thus represent the ingredients directly comparable in size, are arranged under the headings "Granites and Allied Stones," "Sandstones," "Limestones."

Under each illustration will be found a short description, for which the Committee have to thank Mr. J. Allen Howe, the Curator of the Jermyn Street Museum.

Though stones as natural products show gradations and local variations which render those more closely allied distinguishable with difficulty even by an experienced mason, the differences between stones of varying origin are quite marked. The crystalline granite, the fragmental sandstones, the oolitic limestone are readily distinguishable even in hand specimens, while the results of microscopic investigation here represented photographically make such distinctions as the dolomitic rhombs of Mansfield Woodhouse, the calcified granules of Portland Stone, and the fragmental characters of Beer Stone, with its entire absence of oolitic structure, easily discernible.

These photographs should be studied in association with hand specimens of the corresponding stones, and some elementary knowledge of geology and the principles of petrology is obviously necessary for an appreciation of any but the more superficial distinctions. At the conclusion of a brief Introduction for the benefit of the student, which follows this Preface, some sources of this knowledge are indicated.

Mounted sections of actual stones suitable for microscopic examination can be prepared for about eighteenpence, and do not require an elaborate microscope for their study; there is, therefore, no excuse for forgoing the benefits of this method of investigation in the process of selecting a building stone for any important purpose, more especially in the not infrequent cases in which architects are called upon to make a selection from several local stones.

A further contribution to the work by Mr. Munby consists of a valuable chapter entitled "Introduction to the Study of Building Stones," which describes the formation of stones, and enumerates the leading characteristics of a few of the minerals which compose by far the greatest part of all stones. How important the study of the subject is to an architect who has to select the materials for his building may be gathered from the following passages taken at random from Mr. Munby's Introduction :—

Iron pyrites—chemically, sulphide of iron—is perhaps the greatest enemy of all natural mineral building materials. Yellow in colour and metallic in appearance it is easily recognisable, and occurs in small particles or in cubic or bluntly pointed crystals. When finely disseminated, it is particularly liable to decomposition, producing rust with expansion and sometimes therefore disruption. At the same time sulphuric acid, which decomposes other minerals, is produced from the sulphur liberated. Red stains surrounding iron pyrites indicate that decomposition has already set in. This mineral has a very wide vogue, occurring in granites, limestones, and sandstones. Pyrites has been known to produce a pink tint in white marble on exposure owing to oxidation.

In conclusion, it may be stated that the character of a building stone depends chiefly upon its physical structure and its mineral composition. In granitic stones the absence of decomposition, particularly of the felspars and of such minerals as iron pyrites, should be ascertained; while in freestones, the nature of the infilling material, which should not be earthy, the proximity of the grains when the infilling is not wholly crystalline, and (in sandstones) the angularity of the fragments are perhaps the most important considerations. The use of a stone, more particularly when composed to any extent of carbonate of lime, must be considered with reference also to locality, for where much coal is burnt sulphuric acid is always present in the suspended moisture of the atmosphere. . . . .

An examination of the sandstones will show how large a proportion of felspar many contain, and that therefore a study of granitic minerals is essential for the true appreciation of the quality of these fragmental stones. As quartz is itself imperishable, it is the nature and coherence of the infilling minerals which is here of most importance, but it will be observed that the quartz particles in those sandstones which take a leading place among this class of building stone possess considerable angularity.

Among the limestones several marked types present themselves. The oolitic stones, such as Ketton, Portland, and Bath, are easily distinguishable, and it will be further observed that in Portland Stone the infilling calcite occurs in single crystalline masses, whereas in the Bath Stones this infilling, though still calcite, is granular, being made up of many individual crystals, which may explain the superior weathering properties of the former stone. Other limestones, such as Totternhoe and Beer (the latter sometimes fraudulently substituted for Portland), will be seen to be composed of a mass of shell fragments and to present no oolitic structure. Such stones have but small weathering resistance.

The Introduction concludes :—

In the pursuit of this study the student may be referred to *The Geology of Building Stones*, by J. Allen Howe (Arnold, 1910, 7*s*. 6*d*.), which contains much valuable matter in a compact and palatable form, and also a list of works bearing on this subject. An older but still standard work dealing with British building stones, in fact the only book which can claim this exclusive title, is *A Treatise on Building and Ornamental Stones*, by E. Hull (1872). In the R.I.B.A. JOURNAL a Paper entitled "The Examination

of Building Stones," by H. W. Burrows (Vol. IX., 1893), gives some useful information; while a Paper on "Building Stones," by A. T. Walmisley, appears in *The English Mechanic and World of Science*, 6th and 13th August 1875. Mr. Walmisley has also kindly supplied the following references: *Blasting and Quarrying*, Part II., by General Sir J. Burgoyne [Crosby Lockwood]; *The Builder*, Student's Column, "Our Building Stones" (1886), and "Structure and Physical Properties of Building Stones" (1894); *The Builder*, 14th March 1885, "Building Stones," by John Slater. More useful information will be found in *The Quarry*.

The Science Committee at their Meeting on the 11th May last passed the following resolution:—"That the cordial thanks of this Committee be tendered to Mr. Matt. Garbutt and Mr. Alan E. Munby for the great amount of care and time they have devoted to the preparation of the book of 'Micro-Photographs of Building Stones,' and also to Mr. Howe for the assistance he has rendered so willingly in its preparation."

### DECAY IN STONE.

Mr. Alan E. Munby desires to draw the attention of those interested in the supply, use, and preservation of building stones to the efforts of an International Committee to collect information in order to determine the various causes producing decay in stone, more particularly the effect of mortar as influencing deterioration.

The Committee, which is composed of members of the International Association for Testing Materials, and the labours of which are officially recognised by the Royal Institute of British Architects, held a meeting last October, under the presidency of Professor Van der Kloes, and made some careful investigations of the stonework of many important buildings, including Cologne Cathedral under the guidance of its architect, in Holland and Germany. As a result of this meeting the following series of questions has been circulated among those interested with the object of collecting such information as may lead to a proper understanding of the problems connected with the decay of stone under varying conditions:—

1. Nature of building.
2. Situation (*e.g.* address, nature of surroundings, aspect).
3. Material (*e.g.* kind of stone or brick).
4. Date of building (or part under discussion).
5. Mortar used (*e.g.* composition, proportion of sand, analysis or means of obtaining the same).
6. Nature of defect (*e.g.* incrustation, surface scaling, efflorescence, loosening, bulging of half-brick thickness).
7. Suggested cause (*e.g.* percolation of water, frost, defective stone, brick, or mortar, old bond timbers, smoky atmosphere, action of sea water).

Mr. Munby appeals to members to give any details that may be at their disposal by way of answers to the above, or to preserve the list of questions with a view to the possibility of future assistance.

Any details (which will be treated as confidential if desired) should be addressed to the President of the Committee, Professor A. J. Van der Kloes, Delft, Holland, or to Mr. Munby himself.

9 Conduit Street, London, W., 17*th June* 1911.

## CHRONICLE.

### The Annual Elections.

At the Business General Meeting of Monday, 12th inst., the Officers, Council, and Standing Committees for the ensuing Session were declared duly elected, in accordance with the Scrutineers' Reports, as follows:—

#### The Council.

*President.*—Leonard Stokes.

*Vice-Presidents.*—Reginald Blomfield, A.R.A.; Edward Guy Dawber; Ernest Newton, A.R.A.; John W. Simpson.

*Hon. Secretary.*—Henry Thomas Hare.

*Past-Presidents.*—Thomas Edward Collcutt; Ernest George, A.R.A.

*Members of Council.*—Walter Henry Brierley; Walter Cave; Max Clarke; William Flockhart; James Sivewright Gibson; John Alfred Gotch; William Curtis Green; Edwin Thomas Hall; George Hubbard; Arthur Keen; Henry Vaughan Lanchester; Edwin Landseer Lutyens; George Halford Fellowes Prynne; Halsey Ralph Ricardo; Sir Alfred Brumwell Thomas; Edmund Walter Wimperis; William Woodward; Percy Scott Worthington.

*Associate Members of Council.*—Sidney Kyffin Greenslade; Walter John Tapper; Harry Inigo Triggs; Septimus Warwick; Herbert Winkler Wills; Arthur Needham Wilson.

*Representatives of Allied Societies.*—Henry Clement Charlewood (Northern Architectural Association); Sydney Decimus Kitson (Leeds and Yorks Architectural Society); Edgar Wood (Manchester Society of Architects); James Jerman (Devon and Exeter Architectural Society); John Brightmore Mitchell-Withers (Sheffield Society of Architects and Surveyors); Albert Edward Murray (Royal Institute of the Architects of Ireland); William Fleming Wilkie (Dundee Institute of Architecture); Cecil Locke Wilson (Cardiff, South Wales, and Monmouthshire Architects' Society); Joseph Foster Wood (Bristol Society of Architects).

*Representative of the Architectural Association.*—Gerald Callcott Horsley.

*Auditors.*—John Hudson; William Henry Burt.

#### The Standing Committees.

*Art.—Fellows*: Cecil Claude Brewer; Walter Henry Brierley; Walter Cave; William Flockhart; William Adam Forsyth; Gerald Callcott Horsley; Thomas Geoffry Lucas; Edwin Landseer Lutyens; Ernest Newton; Edwin Alfred Rickards.—*Associates*: Sidney Kyffin Greenslade; John James Joass; Walter John Tapper; Harry Inigo Triggs; Septimus Warwick; Arthur Needham Wilson.

*Literature.—Fellows*: Frank Thomas Baggallay; John Alfred Gotch; William Curtis Green; David Barclay Niven; George Halford Fellowes Prynne; Halsey Ralph Ricardo; Charles Sydney Spooner; Sir Alfred Brumwell Thomas; Edward Prioleau Warren; Percy Leslie Waterhouse.—*Associates*: Walter Millard; Herbert Passmore; Charles Edward Sayer; Cyril Wontner Smith; Arthur James Stratton; Herbert Winkler Wills.

*Practice.—Fellows*: Robert Stephen Ayling; Howard Chatfeild Clarke; Alfred William Stephens Cross; Matt. Garbutt; Albert Walter Moore; Charles Stanley Peach; Sydney Perks; Herbert Duncan Searles-Wood; Henry Tanner, Junr.; William Woodward.—*Associates*: Kensington Gammell; John Nixon Horsfield; Charles Edward Hutchinson; Herbert Hardwicke Langston; Herbert Shepherd; Harold Arthur Woodington.

*Science.—Fellows*: Harry Percy Adams; Max Clarke; Frederic Richard Farrow; Ernest Flint; Horace Gilbert; George Hornblower; George Hubbard; John Murray; Ravenscroft Elsey Smith; William Henry White.—*Associates*: George Leonard Elkington; Charles John Marshall; Alan Edward Munby; Digby Lewis Solomon; Ernest William Malpas Wonnacott; Ernest Alexander Young.

The Scrutineers' Reports giving details of the voting form part of the Minutes, pp. 563 and 564.

## ST. PAUL'S BRIDGE.

### Recommittal of the Corporation of London (Bridges) Bill.

The strong protests which have been made by the Institute, by eminent artists, and the Press generally against the St. Paul's Bridge scheme have resulted in the Corporation Bill being sent back to Committee for reconsideration, by 156 to 99 votes. On the motion for the third reading, Mr. Philip Morrell, Member for Burnley, moved as an amendment: "That the Bill be recommitted to the former Committee in respect of the clauses which relate to the construction of a new bridge between Blackfriars and Southwark bridges; that it be an instruction to the Committee on the recommitted Bill not to agree to any scheme for the construction of the proposed new bridge until they are satisfied, first, that the scheme has been prepared under the advice and supervision of a competent architect or architects chosen from among the leading architects of the day; and, secondly, that the scheme, both in respect of architectural design and convenience of traffic, is the one best adapted to the public needs and to the character of the site."

The following is abstracted from *The Times* report of speeches in the House of Commons against the Corporation's scheme:—

Mr. Morrell said that the scheme for the construction of this new bridge, at an estimated cost of £2,250,000, had not been sufficiently considered from the public point of view and was not supported by a sufficient weight of evidence from those best qualified to speak on architectural town planning. In a great national concern of this sort the Corporation ought not to spend what was in effect public money without consulting the best expert advice. Those who voted for his motion would not commit themselves to any particular alternative scheme. All that he asked for was time to consider the best advice that could be obtained. . . . The public interest in this matter was to see that nothing was done to impair the architectural beauty of London and to secure convenience of traffic, and the two were not in any way incompatible. These objects could only be secured by doing what the Corporation had not yet done, and that was by submitting the matter to the best possible advice. This was the greatest scheme of town planning that they were likely to have for some time to come, but, so far from any expert in town planning having been consulted, the scheme had been prepared on the advice of engineers alone. The promoters of the Bill stated that under their scheme there would be an imposing thoroughfare dominated by the dome of St. Paul's. There never was a more misleading description of a scheme brought before the House. The only view of St. Paul's, if it were seen at all, would be a view of it over the intervening houses. Then it was said that the scheme ought to be accepted because it would be so good for traffic. But a direct rectangular crossing was not the best way of getting two great streams of traffic past one another. They were much more easily dealt with by means of an elbow. The rectangular scheme involved sixteen points of collision, whereas the elbow arrangement only involved six points of collision. Any one who had seen the great improvement at Marble Arch or Hamilton Place would appreciate the difference. It was said that the alternative proposals to the scheme of the City Corporation would necessitate the construction of a skew bridge across the Thames. People talked as if that made any alternative scheme impossible. It was not necessary in order to carry a road straight up to St. Paul's that there should be a skew bridge, but if the bridge were not quite at right angles to the river was that really to be considered an insuperable and fatal objection to any alternative scheme? Some of the finest bridges designed by Brunel crossed rivers obliquely. Another objection to the alternative scheme was that the tramway proposal could not be carried out. But did the House realise that the proposed subway would be close to the foundations of St. Paul's? It was not beyond the limits of architectural skill where the road follows a little way round to the south side of St. Paul's, as shown in the architects' scheme, to construct a subway and preserve the stability of the foundations of St. Paul's. Much play had been made by the promoters on the alleged extra cost by a million of an alternative scheme. But there was no evidence that there would be this extra cost. Let the House realise the great opulence of the estate managed by the Corporation for the maintenance and building of bridges. There was a rental of £152,000 a year, and the income would largely increase as leases fell in. Upon a revenue of that sort there should be no hesitation about adopting a good scheme because of an additional expense of £100,000 or £200,000. If the objections were valid they would still hold good upon reconsideration, and a few months' delay for deliberation would not hurt the scheme. This was the greatest opportunity this generation was likely to have to provide an architectural vista that would be unequalled in Europe, and he earnestly urged the House not to decide hastily in favour of a scheme so much condemned.

Lord H. Cavendish-Bentinck seconded the motion. A bridge in the heart and centre of the capital should be built in a way worthy of an Imperial people. Nothing was more remarkable than the patience with which the people of London had submitted to architectural outrages. Much water had flowed under Westminster Bridge since Wordsworth declared he saw from it the finest view in the world, and since then we had built four or five of the ugliest railway bridges in the world. Every great opportunity had been missed and every great highway had been considered, not with any artistic or æsthetic view, but in what Arthur Young called the baneful spirit of the counter. If any part of the population had a claim to the ennobling influences of architecture it was those on the southern side

of the river in a wilderness of mean streets whose only landmark was the Elephant and Castle! The spirit underlying this proposal was the same spirit that had provided the wilderness of mean streets, stuccoed villas, slums, and back-to-back houses, and the House of Commons which lately passed the Town Planning Bill would indeed stultify itself by sanctioning a proposal like this. He believed they ought to give this Committee a further opportunity of hearing architectural opinion on this subject, and it was from the point of view of the danger they were running of having a great eyesore inflicted on the people of London that he seconded the rejection of the Bill.

Sir Alfred Gelder [*F.*], Member for Brigg, Lincolnshire, said if this scheme were allowed to pass it would be one of the most fatal blunders in London architecture that had been committed for centuries. Indeed, it would be more than a blunder: it would be a positive crime, and cruel to posterity. The Cathedral was a national monument of which any nation might be proud, and surely the House did not wish to see repeated the blunder of the bridge across Ludgate Hill. The desire was to open out St. Paul's so that its beauties might be better seen and understood. In his view the Engineer of the Corporation had absolutely ignored the opportunity to obtain for London an advantage which would endure as long as the City endured. The Corporation had also ignored the advice of all those who were best able to give advice on the subject—the architects, artists, sculptors.

Mr. Mooney: If the architects had followed up a suggestion I made they could have come before us with an alternative scheme and given us their opinion.

Sir Alfred Gelder said it was no more the duty of the architects to present an alternative scheme than that of any other class of people. But they did their best to influence the Corporation by deputation and by presenting a petition against the Bill. The hon. baronet touched the spot when he said that to bring the new street in a direct line with the centre of St. Paul's would be an enormously costly process. He was assured on authority that the additional cost would only be about £150,000 or £200,000, but even if it cost a million—which he traversed entirely—he submitted that in a matter of this sort, where Parliament was dealing with a work that would last for centuries, they ought to take a broad and not a narrow view. He traversed entirely the statement that there was danger to the foundations of St. Paul's if any other scheme than this were adopted, and, with respect to the zone of danger which the Commissioner of City Police spoke about, he believed that the traffic could be quite as easily dealt with under any other scheme as under the scheme which had been passed by the Committee. It seemed to him a very great pity that in a matter of this kind the purely utilitarian view of the engineer alone had prevailed and that no regard had been paid to the æsthetic character of the project and to the amenities of the City. When an opportunity like this arose they did not want to repeat mistakes such as had been made before because full and adequate consideration had not been given to the subject. If the Bill went back, evidence could be produced which would show that a scheme could be submitted which would give all the effect of a vista of St. Paul's, and also all the means of locomotion which were so much needed in the congested centre of London.

Mr. Essex pointed out that even if the House instructed the Committee to reconsider this point, they could give powers for a large amount of the work to be at once proceeded with—namely, the reconstruction of Southwark Bridge. That would take about four years, and during that time public opinion would be focussed upon this scheme and Parliament would be less likely then to make a mistake. The City Corporation had considered the project from the utilitarian standpoint, and hon. members, therefore, might not lightly charge the Corporation with a lack of carelessness. But their charge was that the Corporation had not had the opportunity of considering all the artistic considerations involved in the scheme. He challenged the scheme also on the ground that it was inadequate. The Corporation had cut their coat according to their cloth, but he thought they might have dealt more generously with Londoners in view of the rapid growth of their funds. Wherever the bridge was put it should be the widest in London, but from the start it was not going to be so. Another mistake which had been made was in the incompleteness of the connection between north and south, while owing to the tramway tracks and the three lines of traffic the effective width of the bridge, as ordinarily considered, would not be realised. He was the only member of the Committee who voted against the scheme. His colleagues gave the fullest consideration to the case, as he also did, but the inquiry was too limited. The City Council ought to have brought before them a more daring scheme; and if the Bill was sent back e hoped they would be encouraged to take the opportunity boldly by the hand and do the thing well.

Mr. Lyttelton (referring to an objection raised by Mr. Emmott, Chairman of Ways and Means, that the motion to recommit the Bill could not be carried without casting a slur on the Committee) said he did not agree that the recommittal of the Bill involved any slur upon the Committee. The Chairman of Ways and Means seemed to him to have fallen into the error of treating a matter which was of immense importance to London as if it were a mere private matter of litigation between two parties. His proposition was that because the Institute of British Architects had not responded to the invitation of the Committee, London and the public of London were for all time to be treated on the basis that such evidence was not forthcoming. Nothing could be more fundamentally wrong. The interest of the public in this matter was a great one. What had they to do with the default of the architects? He did not blame the Corporation. He believed they had behaved in a frank and generous manner to the architects. They did everything they could to get their evidence, which for some reason was not given. The Committee also were absolutely free from blame, and, indeed, deserved the cordial appreciation of the House. It was perhaps to be regretted that a representation was not made that the evidence of architects was necessary to enable a proper decision to be arrived at. The House would then have been able to order the attendance of any person whom it was considered necessary to summon. The result would have been a decision of the Committee based on full instead of imperfect information.

Lord Balcarres said the question was far too important, and the occasion too unique, for the matter to be settled by a reference to precedent and the propriety of treatment for a Committee. Putting aside smaller and what might be called personal questions which had arisen, the central governing consideration of the controversy was whether this great scheme for a new bridge should go direct towards the greatest architectural feature in the metropolis, or whether the line should be deviated for reasons that were adequate. He was delighted to hear that the bridge was to be designed by a competent architect, but that was not the main point at issue; it was not the structure or design of the bridge, but the direction of the road leading to and from the bridge that was at issue. Surely a House of Commons which passed a town-planning scheme only a year ago and confessed by the passing of this Bill as it stood that that scheme was a dead letter would stultify itself. It was said that the bridge proposed in the alternative scheme would be a skew bridge. All architectural and town-planning precedents justified such a scheme when it was adopted to lead up to a monument of architectural pre-eminence. A skew bridge in this case would be more than justified by the fact that it would lead up to the great dome of St. Paul's and open up a vista which would very soon become a source of genuine appreciation to the scores of thousands of people

who crossed the bridge. It was clearly an exaggeration to say that no tramway could follow anything but a direct route. Any one familiar with the London tramway system would agree that the authorities had never found any difficulty in laying a line along tortuous thoroughfares. He denied that there was any necessary conflict between the artistic and the utilitarian. If they made a mistake now it would be irretrievable, and twenty years hence it would be said that the House of Commons refused to pass this magnificent alternative scheme because it would be hurtful to the feelings of the members of a Committee.

The Instruction to the Committee on the recommitted Bill which formed the second part of the amendment stood over until Thursday when Mr. Morrell moved as follows :—

"That it be an instruction to the Committee not to agree to any scheme for the construction of the proposed new bridge, including the approaches thereto, until they are satisfied that the scheme, both in respect to architectural design and convenience of traffic, is the one best adapted to the public needs and to the character of the site." He only wished to say that he believed the instruction would be accepted by his hon. friend the member for Rochester on behalf of the City Corporation, who, he understood, were prepared to consult some leading architect, as was suggested last night, with a view, if possible, to getting the scheme more into harmony with public opinion and the opinion of the best architects.

Sir F. Banbury, who had spoken against the amendment the previous day, seconded the instruction.

On the motion of Mr. Booth (Pontefract), the instruction was amended so as to make the concluding words read—"One best adapted to the public need and best suited to the character of the site."

Mr. Morton (Sutherland) having stated on behalf of the Corporation that they undertook to call in an independent architect of repute to advise,

The instruction was agreed to.

It may be mentioned that on the afternoon of the 14th, prior to the debate on Mr. Morrell's amendment, Professor Beresford Pite, who has been in constant touch with the Committee who have led the opposition in Parliament against the Bill, attended the House of Commons by invitation with plans showing the various schemes for the information of members. Professor Pite was accompanied by Mr. Morrell and other members of the Committee, and an informal meeting was held on the Terrace.

Professor Pite, interviewed by a representative of the *Westminster Gazette* (reported in a late edition of the 15th), referring to the City Corporation's objection that the more artistic and worthy scheme would give rise to insuperable traffic difficulties, said :

"That criticism of our proposals, curiously enough, is the least convincing. The Corporation argue that the alteration of the approach of the bridge to the south side of the Cathedral would lead to what is commonly called a 'dead end.' But this is a complete misuse of terms. Does Hamilton Place, where it discharges into Piccadilly, discharge into a dead end ? Does Park Lane, at Oxford Street, discharge into a dead end ? Does the Thames Embankment discharge into a dead end at the Clock Tower of the House of Commons or at Blackfriars Bridge ? If so, our scheme for the new bridge would certainly fall beneath this criticism. But these ends, we know well enough, are anything but dead ; and the end of the alternative bridge, so far from being dead, would receive the traffic and distribute it east and west and north much better in the extended space of St. Paul's Churchyard than by impinging the north and south traffic upon the east and west traffic at the point of intersection with Cannon Street. A practical illustration of the kind of situation that would arise under the Corporation scheme is to be found at the end of Waterloo Bridge, where the traffic east and west of the Strand is impinged upon by the traffic of the bridge north and south ; and this familiar congestion would, of course, be greater in the case of the heavy traffic over St. Paul's Bridge. . . .

"It is imperative," Professor Pite concluded, "that the plan of the bridge and its approaches should be reconsidered in conference with competent architectural advisers. In other words, a new and proper plan must be submitted to Parliament. A good deal was said last night in the House of Commons about the duty of the Royal Institute of British Architects ; but it cannot be pretended that it is the duty of that body to prepare plans in opposition to those officially produced by the Corporation. They are not in a position to obtain valuations of the properties, and to negotiate with their owners, or undertake the necessary practical work. The Institute, in its public capacity, is interested in the art of architecture ; and in this matter of St. Paul's Bridge it is really the friend of the City. If the Corporation require an honorary committee of architects to advise them, the President of the R.I.B.A. would form one immediately."

To complete the record given in these pages of the letters on this subject which have appeared in *The Times* from the President of the Institute and Royal Academicians, it has to be mentioned that a letter appeared on the 10th June from Mr. Ernest George, A.R.A. [*F.*], Sir George Frampton, R.A. [*H.A.*], Mr. Reginald Blomfield, A.R.A. [*F.*], Mr. John S. Sargent, R.A. [*H.A.*], Sir L. Alma Tadema, O.M., R.A. [*H.F.*], Sir Thomas Brock, R.A. [*H.A.*], and Mr. John Belcher, R.A. [*F.*], recalling their previous letter, in which they had pointed out that the carrying out of the Corporation's scheme must inevitably leave an indelible mark on the scenery of the river, and pleading that some assurance might yet be given that this great opportunity for increasing the architectural beauty of London would not be missed. The Corporation's scheme, they again urged, had no claim whatever to be considered as carrying with it any artistic or architectural authority. They trusted that the House of Commons, by passing the motion to recommit the Bill, would show themselves mindful of future generations for whom they are trustees, and do all that was possible to secure the formation of a scheme and the building of a bridge that would be worthy of the historic site.

### Another Alternative Scheme.

Some particulars appeared in *The Times* last Tuesday of an alternative scheme prepared by Mr. W. Henry White [*F.*]. Generally the plans follow the lines of the City's scheme, which provides for a northern approach to the proposed St. Paul's Bridge at Old Change, adjoining the east end of the Cathedral. Mr. White proposes, however, that the

approach should be "Y"-shaped, so that while one extremity would abut upon the east end of the building the other would be carried to a point near the west end. Between the two arms of this divergent road there would be an opportunity, it is urged, for a piece of town planning on a scale worthy of London. At the same time the vista of the dome and south front of St. Paul's would be opened up, as suggested in the scheme advocated by Professor Beresford Pite and described in *The Times* of 22nd April. It is further claimed that Mr. White's scheme would have the effect of dividing the traffic passing over the bridge into two main streams to and from the east and the west, and thus avoid the congestion of traffic which, it is argued, would take place at the south-east corner of St. Paul's Churchyard if the Corporation's scheme were adopted.

### The Ninth International Congress of Architects, Rome, Oct. 2-10, 1911.

Among the distinguished visitors present at the Meeting last Monday was Signor Cannizzaro, of Rome [*Hon. Corr. M.*], and at the conclusion of the discussion on Mr. Richmond's Paper the Chairman addressed to him a few words of welcome and, introducing him to the Meeting, stated that Signor Cannizzaro, who was President of the Executive Committee of the International Congress of Architects to be held at Rome next October, had kindly consented to say a few words about the Congress, and the arrangements that were being made for the entertainment of those who were to take part in it.

Signor Cannizzaro said he felt much honoured in having the opportunity to convey to English architects the very cordial salutations of their Italian brethren. There were being held in Rome this year a long series of International Congresses for various objects. These Congresses were a necessary complement of the Exhibition which was being held to celebrate the Jubilee of the Unification of Italy. They had been greatly helped by other nations, especially by England, in uniting the various States of the country into the present Kingdom under the Savoy dynasty; and they thought it their duty, in celebrating the Jubilee of their Unification, to prove to the other countries that in making Italy a united nation they were not only consolidating a country strong by force of arms, but strong by the intelligence of a people who were striving to advance in science, in art, and in everything which conduced to the well-being and improvement of humanity. It was for this reason that this long series of Congresses was being held, and Italian artists were hoping to have as their guests in Rome as large a number as possible of English architects. They would be glad to show to their colleagues of other nations the work done in this branch of art in Italy, to enable Italian architects to keep the place they now hold, and to which they had been helped by other nations. The Congress would be held in October, from the 2nd to the 10th, and would be under the patronage of the King, with, as Honorary Presidents, the Minister of Public Instruction, the Minister for Art, and the Minister for Foreign Affairs. The Congress would last for a week, and at its close the Organizing Committee hoped to bring all those attending it to Venice, to show them the tower of San Marco, and other monuments of interest.

Some particulars of the Congress appeared in the JOURNAL for the 18th February, and detailed programmes of the proceedings, excursions, &c., are promised by the Italian authorities at an early date. These will be issued to members of the Institute as soon as received. Meanwhile it should be noted that members of the Congress consist of two classes—viz. "Full Members," comprising, among others, all architects, and persons who follow the professions connected with architecture; "Associate Members," comprising the wives and children * of Full Members, and architectural students. The subscription for Full Members is 25 lire (£1) and for Associate Members 15 lire (12*s*.). Members of both classes have the same rights to reduced fares on the Italian railroads, to special reductions for apartments, to special cards of admission to the galleries, museums, and other institutions, and to attend the meetings of the Congress and visits.

The subjects for discussion include :—

(*A*) Reinforced Concrete : its Employment in Different Countries and the Opportunities for its Application to Artistic Construction from the Technical and Decorative Point of View.

(*B*) The Question of an International Gazette of Architectural Bibliography.

(*C*) The Exercise of the Profession by an Architect in Countries other than his own.

(*D*) Observations on Modern Architecture.

(*E*) The Execution of the Architectural Work of Governments and other Public Bodies.

(*F*) The Rights and Duties of an Architect in regard to his Client.

(*G*) The Utility of an International Comparative Dictionary of Architectural Terms.

*Extra Subject.*—Foreign Academies at Rome : Their History, the Resulting Studies and Designs of the Students, and the Influence exercised by these Schools in the Countries they represent.

All duly enrolled members have the right to send papers and resolutions for discussion on the various subjects of the programme. These must be sent to the Organising Committee at least four months before the opening of the Congress, and be drawn up in French. If possible an abstract of the papers and other communications translated into several languages will be issued prior to the opening of the Congress.

Applications for membership from persons resi-

* A Full Member has the privilege of nominating not more than two members of his family as Associate Members.

dent in the United Kingdom should be made to Mr. John W. Simpson, F.R.I.B.A., Secretary of the British Section of the Comité Permanent International des Architectes, 9 Conduit Street, Regent Street, W.

### Dr. Dörpfeld's Researches at Corfu.

*The Times* recently gave an interesting account of the excavations at Corfu now being carried out at the expense of the German Emperor by Dr. Wm. Dörpfeld, the eminent archæologist who is to receive the Royal Gold Medal at the General Meeting of the Institute on the 26th inst.

The site is that of the ancient city of Corcyra, some two miles to the south of the modern town. The district is still locally known as Palaeopolis; the acropolis of the ancient city crowned the ridge of the peninsula, on the eastern slope of which stands King George's villa, Mon Repos. The ancient town was sacked by the Goths in the sixth century A.D., and was never rebuilt.

Researches have been carried out at various times on the site of Palaeopolis; among the more interesting results was the discovery of the ancient cemetery in 1843; here the well-known tomb of Menecrates was brought to light with a metrical inscription in the primitive Corcyraen alphabet, and a fine lioness of archaic workmanship, now preserved in the Royal Palace. It was reserved for a peasant, however, to initiate the new series of discoveries while digging in a field.

The sculptures so far uncovered apparently belong to the western pediment of a very large temple, and it is now possible to determine their arrangement with tolerable certainty. The central group represents Perseus slaying the Gorgon Medusa, while the winged horse Pegasus springs from her blood. The gigantic form of Medusa, with one knee bent to the ground, is in strange contrast with the smaller figures of Perseus to her left and Pegasus to her right; her head is encircled with ringlets of snakes; two larger serpents descend with sinuous motion on either side behind her arms, and long curls of hair, precisely similar to those affected by ladies of the earlier Victorian epoch, fall on her breast. Her chiton, which has an ornamented border, is clasped round the waist by two serpents, admirably delineated, whose heads with forked tongues face each other in front. Her feet are clothed with *cothurni*. On the right breast and arm of the Gorgon are traces of red colouring; the background on either side of her figure is sculptured in featherwork, which seems intended to indicate that she had wings.

On either side of the central group are two colossal "couchant" lions, or perhaps leopards, with their heads turned towards the spectator. Both heads and the body of the lion to the right of the Gorgon have been found. These imposing animals act as supporters to the central subject, which they separate from the smaller groups on either side; they are apparently purely ornamental, and their presence seems in conflict with the unity of design which generally characterises a series of pedimental sculptures.

Of the groups thus detached from the central figures and probably referring to distinct legends, that on the spectator's left displays a goddess seated by an altar and warding off with her hand a spear hurled by an assailant, whose figure has not yet been found. The corresponding group on the right represents Zeus slaying a Titan with a thunderbolt. A tree by the side of this group corresponds with the altar by the side of the goddess. On the extreme left, in the angle of the tympanum, are the head and shoulders of the recumbent figure of a bearded warrior. The slab containing the nether limbs is missing.

The temple, in Dr. Dörpfeld's opinion, was probably that of Apollo, and concluding that the sculptures belonged to the western pediment of the temple, Dr. Dörpfeld has carried out excavations to the east, but so far no traces of the foundations have been revealed. His theory, however, has been confirmed by the discovery of a triglyph, of several fragments of fluted columns, of some portions of the cornice, of a paved area, which apparently extended in front of the entrance, and of a row of stone blocks which seem to have supported the platform between the peristyle and the wall of the eastern front. From such indications as are now available it seems probable that the temple was a Doric hexastyle or perhaps octastyle; it measured about 48 metres in length by 20 in breadth, and its height was perhaps about 14 metres. It was thus about the same size as the Heraeon at Olympia and somewhat larger than the temple at Selinus. It probably dates from the beginning of the sixth or the end of the seventh century B.C. The sculptures, which, as well as the cornice, were evidently coloured, bear a general resemblance to those of the early temples on the acropolis of Athens.

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On Thursday, the 22nd June, M. Honoré Daumet celebrates the jubilee of the foundation of his atelier in Paris. The Institute will be glad to take this opportunity of congratulating its veteran Corresponding Member and Royal Gold Medallist on this auspicious occasion, and on the brilliant success of the pupils who have profited by his instruction, among whom have been no fewer than nine Grand Prix Students.

The Annual Exhibition of the British School of Archæology in Egypt will open on the 26th inst. Roman portraits, sculptures from the Labyrinth and Memphis, prehistoric vases, flints, &c., found by Prof. Flinders Petrie and students, will be shown at University College, Gower Street, from June 26 to July 29 from 10 to 5, and evenings July 5, 15, 25, from 7 to 9. The Hon. Secretary, Mr. H. Flinders Petrie, will be in attendance from 11 to 1.

# LEGAL.

## Construction and Effect of Trade Guarantee: Architect as Arbitrator or Quasi-Arbitrator.

CARMICHAEL *v.* THE STONWOD FIREPROOF FLOORING CO., LTD.

The appeal of the plaintiff in this case from a decision of Mr. Justice Bucknill in favour of the defendants was heard on 30th May before Lord Justice Vaughan Williams, Lord Justice Fletcher Moulton, and Lord Justice Farwell.

The appeal was allowed, with costs, Lord Justice Vaughan Williams dissenting.

The point at issue was whether the architect (Mr. Reginald Blomfield, A.R.A.) was in fact an official arbitrator. The defendants urged that he was, and was therefore bound to proceed with all the formalities of an arbitration case. The plaintiff contended that he was not, and that the decision that he arrived at was valid, and his procedure correct. The plaintiff's view has now been upheld on appeal. Lord Justice Fletcher Moulton, in giving judgment, said:

This is an appeal from the judgment of Mr. Justice Bucknill in favour of the defendants in an action brought under the following circumstances. The plaintiff was the building contractor employed by a Mr. Buckley to carry out certain work upon his house. That work included the laying of certain floors, and the defendant company, which is a company whose special business it is to lay such floors in a material covered by patents which they possess, was desirous that the execution of this part of the work should be entrusted to them. The plaintiff was unwilling to take this course unless he was protected in case the building owner should not approve the floors when laid, and accordingly before the order was given to defendants they gave a guarantee in the following terms:—"*Re* Stonwod Floors to be laid at Mountsmere Manor. We hereby guarantee these floors subject to fair wear and tear for a period of three years; also that if the floors are unsatisfactory to your client, Mr. Buckley, we will refund to you the money you have paid us for laying them, subject to the faults, if any, being due to no cause beyond our control. The decision of the architect, Mr. Reginald Blomfield, to be binding on both sides. For the Stonwod Flooring Co., Ltd., R. Chinery Lee (Secretary)."

It is on the construction and effect of this guarantee that the question in the present case turns.

The floors when laid did not give satisfaction. The defects which first made their appearance were remedied, but in April 1910 Mr. Buckley definitely decided that the flooring was unsatisfactory and must be replaced. The question then rose as to whether the "faults, if any," were due to causes beyond the control of the defendants, a matter which under the guarantee was to be decided by the architect under whose supervision the whole of the work has been carried out, Mr. Reginald Blomfield. He made an appointment to meet the representatives of the plaintiff and defendants at the house, and examined the floors and discussed the whole question with them. He seems also to have made inquiries of his own with regard to the accuracy of certain allegations of the defendants' representative to the effect that the floors had been washed too soon after they had been laid. There is no suggestion that Mr. Blomfield showed any partiality towards either of the parties, or refused to hear them in any way. Having taken such steps as he thought necessary to enable him to come to a decision, he decided that the defects were not due to causes not under the control of the defendants, and the plaintiff having obtained this decision in his favour has brought this action against the defendants to recover the money paid to the defendants for laying the floors. The defence which the learned Judge has held to be an answer to this claim is that the guarantee was a submission to arbitration, and that Mr. Blomfield was bound to hold an inquiry in accordance with the provisions of the Arbitration Act, 1889, and that accordingly (amongst other things) his award must be given in writing, and that, as this was not done, his decision is of no validity, and the plaintiff fails in his action.

There is, in my opinion, a fundamental error in law which underlies the whole of the judgment of the learned Judge. He has held that the guarantee is a submission to arbitration within the provisions of the Arbitration Act, 1889. But the definition clause of that Act is clear, and it is to the effect that a "submission" means a written agreement to submit present or future differences to arbitration whether the arbitrator be named therein or not. Now it is impossible to call this guarantee a written agreement. It is only signed by one of the parties, and therefore whatever be its other legal consequences it cannot be a submission under the Arbitration Act, 1889, and that Act does not apply in any way to it. Putting aside, therefore, the Arbitration Act, 1889, it remains to consider what is the true construction and effect of the guarantee in this case. In my opinion the document is not difficult to construe. It recognises that Mr. Buckley, the building owner, is entitled to reject the floors if they are unsatisfactory to him. And it is common ground that he has so rejected them. The document then provided that the defendants will refund to the plaintiff the money paid for the laying of the floors in a certain contingency—that is to say, in case the "faults, if any," are due to no causes beyond the control of the defendants, and the architect is appointed to decide authoritatively between the parties whether this contingency has or has not arisen. It is contended on behalf of the defendants that this means that he is to be arbitrator between the parties and to decide only after holding a judicial inquiry with all the formalities of an arbitration under the Act. I can see nothing in the language used which justifies such an interpretation. On the contrary it is in my opinion clear that such was not the intention of the parties. The amount at stake was small, something less than £70. The person chosen to decide the point was the architect under whose supervision the building operations were actually to be carried on, and who was necessarily and was known to the parties to be a person possessed of experience and technical knowledge in such matters.

There is nothing in the language used which points to any formal inquiry. I come to the conclusion therefore, as a matter of construction, that it was intended that the architect should decide the question after such examination and investigation as he considered sufficient to enable him to do his duty. There is nothing in English law which prevents parties from agreeing that in any particular question they will abide by the opinion of a third party, such opinion being formed by him as he would do it in the ordinary affairs of life. In such a case as the present, I should feel slow to decide that the parties contemplated formal arbitra-

tion with all the incidents of litigation as a necessary preliminary to a person in the position of the architect deciding as between them such a matter as this. No doubt there are errors of conduct which might nullify a decision if improperly arrived at even in a proceeding so informal—as, for instance, if the decision were given by drawing lots, or after hearing one side and refusing to hear the other. In such case the Courts would hold that no proper decision had been arrived at at all. But the fact that the decision is one which has a judicial element in it does not connote to my mind that the intention of the parties must necessarily be that the person giving it must follow any special procedure other than that which, in practical life, a responsible man would think suitable to guide him to a fair decision. Viewed from the standpoint of his duties in such a case, the architect's conduct appears to me to have been free from reproach, and the decision he has given is in my opinion binding on both parties.

I am, therefore, of opinion that this appeal should be allowed, and judgment entered for the plaintiff in the action for the sum claimed, with costs of the action and of this appeal.

Lord Justice Farwell, who concurred, referring to the construction of the guarantee, said:

Does the guarantee contain a reference to arbitration within the Arbitration Act, or is it a mere reference to the architect as a quasi-arbitrator (to use the phrase of Lord Collins in Chambers *v.* Goldthorp, 1901, 1 Q.B. 624, 638–9). There is no question here of the architect being the agent of either party, only so as to be liable for negligence by him he is to decide between the parties either as arbitrator or as quasi-arbitrator. The distinction is material. The arbitrator has to hear and determine judicially, with power to call witnesses and administer oaths, and must make a formal award in writing; the latter is not bound so to act; his duty is to act impartially, honestly, and *bona-fide*, the matter being referred to him on account of his position and the knowledge that he is assumed by the parties to possess by means of which he will be able to say what is fair between them without the expense and delay of a formal arbitration. See *Re* Dawdy, 15 Q.B.D. 426. In my opinion the reference in the present case to "the Architect, Mr. R. Blomfield," is to him as quasi-arbitrator for the following reasons: the amount at stake is between £60 and £70; Mr. Blomfield is a well-known architect who has supervised the erection of the mansion-house in part of which these floors were laid; it may fairly be assumed that the parties contemplated that such questions and suggestions as did actually arise would arise. Thus, the suggestion that the unsatisfactory state of the floors was due to defects in, or sinking of the concrete on which they were laid, could only have been conclusively disposed of in a formal arbitration, by taking up the floors and examining the concrete below—an expensive and troublesome work—but the architect who had superintended the laying of the concrete was able to dispose of the point from his own knowledge and experience acquired during the progress of the works.

Again, the other suggestion was that the floors had been washed too soon. The architect satisfied himself by inquiry from Mr. Buckley, and, through him, of the servants, that he (Mr. Buckley) had not gone into the house for two or three months after the floors were laid, and that the floors had not been washed previously: the defendant was present and did not suggest any cross-examination of Mr. Buckley or the servants.

If there had been a formal arbitration, there would have been evidence on oath, with cross-examination. I do not think that the parties contemplated anything of the sort; their real object was to have the matter speedily and cheaply settled, without much expense or delay, trusting to the architect's familiarity with the matter and to his fairness and honesty. Further, the guarantee does not purport to be a submission to arbitration by both parties, nor is it signed by both parties as is, in my opinion, required by Section 27 of the Act: for the writing maintained in that section necessarily extends to all the material parts of the submission and the signatures are most material. It is true that a party to a submission signed only by the other side is estopped from setting up such want of signature if he himself sues on the award made under it—(Baker *v.* Yorkshire Fire and Life Insurance Company, 1892, 1 Q.B. 144)—but when, as here, it is an open question whether the architect is arbitrator or quasi-arbitrator, there can be no such estoppel, and the fact that there is no document signed by the plaintiff which can be read as an adoption in writing of the submission goes to show that neither party so regarded it.

On the construction therefore of this guarantee, I am of opinion that the architect was not an arbitrator but a quasi-arbitrator, and that his decision, although after an informal inquiry, and without such evidence as would have been required if there had been an arbitration under the Act, is binding because it is admittedly made honestly and *bona-fide*.

## MINUTES. XV.

At the Fifteenth General Meeting (Business and Ordinary) of the Session 1910–11, held Monday, 12th June 1911, at 8 p.m.—Present: Mr. E. Guy Dawber, *Vice-President*, in the Chair; entered in the attendance-book the names of 19 Fellows (including 8 members of the Council), 23 Associates (including 2 members of the Council), 3 Hon. Associates, 1 Hon. Corresponding Member, and several visitors—the Minutes of the Meeting held 22nd May 1911 were taken as read and signed as correct.

The following Licentiates attending for the first time since their election were formally admitted by the Chairman—viz.: Arthur Hadley Fagg, John Morley, Russell Scott Scholefield, William John Wilsdon.

The Hon. Secretary having announced the receipt of a number of books presented to the Library, a cordial vote of thanks was passed to the donors.

The Secretary read the following Reports:—

*To the Chairman of the General Business Meeting, Monday, 12th June 1911,—*

The Scrutineers appointed to count the votes for the Annual Election of the Council and Standing Committees beg to report that 767 envelopes were received, and the results are as follows:—

President.—Leonard Stokes (unopposed).

Past Presidents.—Thomas Edward Collcutt; Ernest George (unopposed).

Vice-Presidents.—*Elected*: Reginald Blomfield, 575 votes; Ernest Newton, 575; E. Guy Dawber, 495; John W. Simpson, 394.

*Not elected*: Beresford Pite, 366 votes; A. W. S. Cross, 309.

10 invalid papers.

(*Signed*) J. Leonard Williams, Edward B I'Anson, *Chairman.*

Honorary Secretary.—Henry T. Hare (unopposed).

Representatives of Allied Societies.—H. C. Charlewood, Newcastle; S. D. Kitson, Leeds; Edgar Wood, Manchester; James Jerman, Devon; J. B. Mitchell-

Withers, Sheffield; A. E. Murray, Ireland; W. F. Wilkie, Dundee; C. L. Wilson, Cardiff; J. F. Wood, Bristol (unopposed).

Representative of the Architectural Association.—Gerald Horsley (unopposed).

Honorary Auditors.—John Hudson; William Henry Burt (unopposed).

Members of Council.—*Fellows.—Elected*: J. A. Gotch, 520 votes; H. V. Lanchester, 473; E. L. Lutyens, 464; E. T. Hall, 462; J. S. Gibson, 461; H. Ricardo, 449; W. Flockhart, 413; W. Cave, 396; W. Brierley, 390; Sir A. B. Thomas, 372; G. Hubbard, 336; A. Keen, 332; Max Clarke, 328; G. H. F. Prynne, 323; W. C. Green, 316; P. S. Worthington, 313; W. Woodward, 307; E. W. Wimperis, 306.

*Not elected*: H. P. Burke Downing, 302 votes; W. Dunn, 302; H. H. Statham, 300; W. A. Forsyth, 285; M. B. Adams, 280; S. D. Adshead, 271; M. Mackenzie, 271; E. P. Warren, 264; C. H. B. Quennell, 244; A. S. Snell, 239; A. N. Paterson, 228; W. H. White, 209; S. P. Pick, 208; A. Thornely, 202; B. F. Fletcher, 170; S. Perks, 168; P. Ogden, 152; J. B. Wilson, 128; T. Eccles, 108; G. E. Nield, 86; P. B. Tubbs, 71; E. J. Sadgrove, 50.

23 spoilt papers.

(*Signed*) Arthur W. Cooksey, Allan Graham,
H. S. East, George Edw. Withers,
F. R. Gould Wills, Henry James Wise,
A. Edward Hughes, Edward B. I'Anson,
*Chairman.*

Associate Members of Council.—*Elected*: S. K. Greenslade, 537 votes; A. N. Wilson, 473; H. I. Triggs, 438; W. J. Tapper, 404; S. Warwick, 345; H. W. Wills, 334.

*Not elected*: C. E. Hutchinson, 290 votes; G. A. T. Middleton, 266; K. Gammell, 215; A. C. Dickie, 208; E. V. Harris, 189; H. A. Saul, 150.

10 spoilt papers.

(*Signed*) Horace M Wakley, Percy P. Cotton,
Edward B. I'Anson, *Chairman.*

Art Standing Committee.—*Fellows.—Elected*: Newton, 623 votes; Lutyens, 530; Rickards, 482; Horsley, 474; Cave, 461; Brierley, 451; Flockhart, 449; Brewer, 418; Forsyth, 407; Lucas, 401.

*Not elected*: Adshead, 321 votes; Wood, 300; Statham, 286; Clapham, 243; Kitson, 237; Bateman, 235; Reay, 147.

*Associates.—Elected*: Greenslade, 614 votes; Needham Wilson, 582; Triggs, 579; Tapper, 564; Warwick, 499; Joass, 492.

*Not elected*: Dawson, 325 votes.

1 spoilt paper; 2 blank papers.

(*Signed*) R Heath Mew, C. Barry Cleveland,
Henry J. Chetwood, Edward B I'Anson,
*Chairman.*

Literature Standing Committee.—*Fellows.—Elected*: Gotch, 613 votes; Ricardo, 553; Green, 534; Waterhouse, 531; Baggallay, 527; Warren, 475; Prynne, 467; Thomas, 438; Niven, 423; Spooner, 378.

*Not elected*: Fyfe, 367 votes; Jemmett, 311; Favarger, 278; Taylor, 231; Sirr, 219.

3 forms rejected.

(*Signed*) Albert Howell, Hylton B. Elkington,
A. Wyatt Papworth, Edward B. I'Anson,
*Chairman.*

*Associates.—Elected*: Millard, 565 votes; Stratton, 528; Smith, 519; Passmore, 461; Wills, 422; Sayer, 395.

*Not elected*: Lishman, 373 votes; Hiorns, 281.

(*Signed*) Albert Howell, Hylton B. Elkington,
A. Wyatt Papworth, Edward B. I'Anson,
*Chairman.*

Practice Standing Committee.—*Fellows.—Elected*: H. D. Searles-Wood, 528 votes; H. C. Clarke, 481; W. Woodward, 475; C. S. Peach, 451; A. W. S. Cross, 442; M. Garbutt, 434; H. Tanner, Junr., 421; S. Perks, 419; R. S. Ayling, 365; A. W. Moore, 361.

*Not elected*: J. Hudson, 355 votes; W. G. Wilson, 350; H. A. Satchell, 331, G. E. Nield, 261; E. Seward, 247; F. W. Marks, 224.

(*Signed*) Fredk. Ernest Williams, E. Brantwood Maufe,
J. Douglas Scott, Edward B. I'Anson,
*Chairman.*

*Associates.—Elected*: C. E. Hutchinson, 508 votes; J. N. Horsfield, 503; H. H. Langston, 443; H. Shepherd, 432; K. Gammell, 415; H. A. Woodington, 396.

*Not elected*: J. C. Nicol, 376 votes; J. W. Stonhold, 326.

(*Signed*) Fredk. Ernest Williams, E. Brantwood Maufe,
J. Douglas Scott, Edward B. I'Anson,
*Chairman.*

Science Standing Committee.—*Fellows.—Elected*: Max Clarke, 605 votes; John Murray, 571; George Hubbard, 569; H. Percy Adams, 566; R. Elsey Smith, 561; F. R. Farrow, 557; George Hornblower, 539; E. Flint, 536; H. Gilbert, 501; W. H. White, 470.

*Not elected*: E. R. Barrow, 469 votes.

*Associates.—Elected*: E. W. M. Wonnacott, 369 votes; G. L. Elkington, 311; E. A. Young, 308; Alan Munby, 302; C. J. Marshall, 282; Digby L. Solomon, 274.

*Not elected*: R. J. Angel, 262 votes; H. W. Burrows, 257; J. H. Markham, 256; J. P. Clark, 210; E. J. Bennett, 208; H. A. Saul, 184; W. R. Davidge, 178; J. E. Franck, 105.

(*Signed*) Alex. G. Bond, J. Leonard Williams,
B. K. Caulfield, Edward B. I'Anson,
*Chairman.*

On the motion of the Chairman a hearty vote of thanks was accorded to the Scrutineers for their labours in connection with the elections.

The following candidates for membership were elected by show of hands under By-law 10:—

As Fellows (6).

GRAYSON: Hastwell [*A.* 1897] (Liverpool).
LOCHHEAD: James [*A.* 1894] (Hamilton, N.B.).
LOW: William Ralph [*A.* 1886].
NEUBRONNER: Henry Alfred [*A.* 1899] (Penang, Straits Settlements).
POTTER: Francis John [*A.* 1909].
SUTCLIFFE: George Lister [*A.* 1891].

As Associates (9).

AIRD: James Albert [*Qual.* 1910] (Montreal, Quebec).
ARNOTT: Charles Dudley [*Qual.* 1910] (Shanghai,).
AYRE: David Wickham [*Qual.* 1910].
COLLINS: Alfred Francis [*Qual.* 1910] (Windsor Castle).
COLVILLE: David [*Qual.* 1910] (Vancouver, B.C.).
CORNWELL: Arthur Redfern [*Qual.* 1910].
MONSBOURGH: Alan Gordon [*Qual.* 1909] (Johannesburg, S. A.).
PATON: William Mortimer [*Qual.* 1893] (Dublin).
TREBILCO: Arthur Floyd [*Qual.* 1910] (Melbourne, Australia).

The Secretary further announced the nomination of the 397 candidates for Licentiateship whose names were printed in the Supplement for the 6th May.

A Paper by Mr. Ernest Richmond, *Licentiate*, entitled Building Methods in Egypt, having been read by the author and illustrated by lantern slides, a discussion ensued, and a vote of thanks was passed to Mr. Richmond by acclamation.

Signor M. E. Cannizzaro [*Hon. Corr. M.* Rome], at the invitation of the Chairman, briefly addressed the Meeting on the subject of the International Congress of Architects to be held at Rome from the 2nd to the 10th October next.

The proceedings closed and the Meeting separated at 10.20 p.m.